(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 May 2001 (17.05.2001)

PCT

(10) International Publication Number
WO 01/34309 A2

(51) International Patent Classification[7]: B05B 13/04

(21) International Application Number: PCT/NL00/00772

(22) International Filing Date: 25 October 2000 (25.10.2000)

(25) Filing Language: Dutch

(26) Publication Language: English

(30) Priority Data:
1013384 25 October 1999 (25.10.1999) NL
1015263 22 May 2000 (22.05.2000) NL

(71) Applicant and
(72) Inventor: VROLIJK, Peter, William [NL/NL]; Koningslaan 63, NL-1406 KG Bussum (NL).

(74) Agent: BARTELDS, Erik; Arnold & Siedsma, Sweelinckplein 1, NL-2517 GK The Hague (NL).

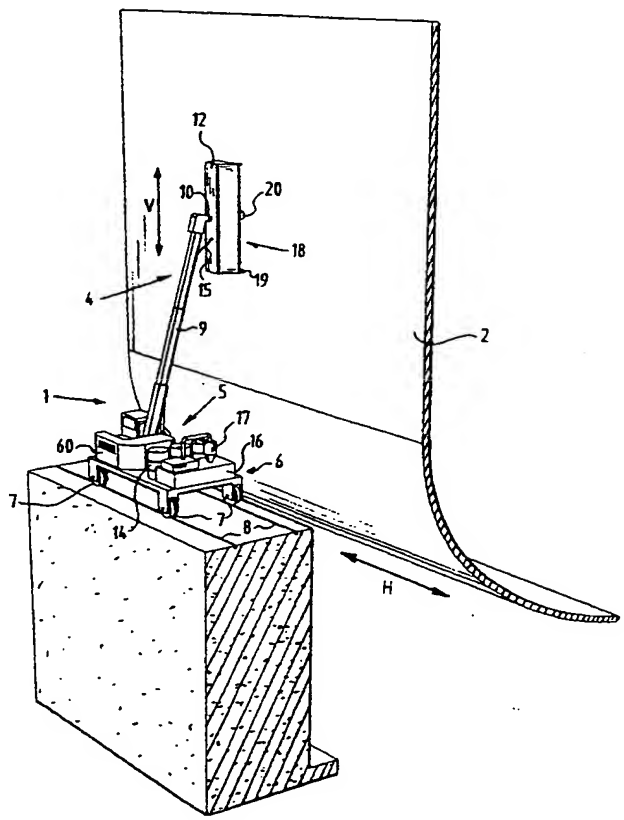
(81) Designated States *(national)*: JP, US.

(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published:
— *Without international search report and to be republished upon receipt of that report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD AND DEVICE FOR SPRAYING A SURFACE AND SPRAY NOZZLE FOR USE THEREWITH



(57) Abstract: The invention relates to a method for spraying a surface, by causing the spray nozzle to move by mechanical means through a determined stroke length in a first direction along the surface, wherein the first and second direction enclose an angle, this such that a spraying pattern is formed with parallel strips running in the first direction. The spray nozzle can be moved reciprocally through the stroke length in the first direction, wherein it may be active only during the forward stroke or the return stroke. The spray nozzle can be moved in the second direction such that edge parts of adjacent strips overlap each other and undergo the same spraying treatment as other parts of the strips. After spraying of a width a determined number of strips the spray nozzle can be displaced through the stroke length in the first direction, whereafter a subsequent width can be sprayed with a number of parallel strips, wherein edge parts of strips in adjacent widths can once again overlap each other. The mist created during spraying can be extracted and separated. The invention also relates to a device for performing the described method.

WO 01/34309 A2

METHOD AND DEVICE FOR SPRAYING A SURFACE AND SPRAY NOZZLE FOR USE THEREWITH

The invention relates to a method and device for spraying a surface. Herein "spraying" is understood to mean any treatment whereby a fluid fed under pressure is pressed through one or more openings with force and strikes against the surface. Examples of such spraying treatments are the applying of a paint layer, cleaning with a liquid under high pressure or blasting the surface with sand or grit.

Spraying treatments have heretofore usually been performed manually. Particularly when large surfaces are being sprayed, such as for instance the hull of a ship, this is time-consuming and labour-intensive. This is a drawback, since it is an ever-growing problem to find suitable personnel for this type of work. In addition, productivity is so low with manual spraying that a ship has to spend an unnecessarily long - literally costly - time in a dock so as to be sprayed. Manual spraying moreover does not always result in a completely uniform treatment. Finally, the environmental impact resulting from manual spraying is relatively high, since manual sprayers generally take a small and light form and cannot therefore be furnished with provisions for discharging excess spray mist.

The invention has for its object to propose a method with which a rapid, efficient and uniform treatment of the surface for spraying is achieved, and whereby there is also the smallest possible impact on the environment.

According to a first aspect of the invention there is provided for this purpose a method which is characterized by causing at least one spray nozzle to move by mechanical means through a determined stroke length in a first direction along the surface and causing the at least one spray nozzle to move in a second direction along the surface at least at the end

of the stroke length, wherein the first and second direction enclose an angle, this such that a spraying pattern is formed with substantially parallel strips running in the first direction. The most uniform possible spraying treatment of the surface is achieved by moving the spray nozzle(s) in parallel strips over the surface.

The at least one spray nozzle is preferably moved reciprocally through the stroke length in the first direction. The at least one spray nozzle can herein be active only during the forward stroke or the return stroke, whereby for instance a single layer of paint can be applied in parallel strips.

In order to increase the processing speed the at least one spray nozzle is moved continuously along the surface in both the first and the second direction.

Advantageously the at least one spray nozzle is further moved in the second direction such that edge parts of adjacent strips at least partially overlap each other, and particularly such that the at least partially mutually overlapping edge parts undergo the same spraying treatment as other parts of the strips. The treatment is hereby optimally uniform over the entire width of the strip.

In order to prevent excessive application at the end of the stroke length when the movement of the spray nozzle(s) is slowed down, the spraying is preferably interrupted when the at least one spray nozzle reaches the end of the stroke length. In order to better spread the application, the at least one spray nozzle can also be moved in a third direction when it reaches the end of the stroke length.

When the surface for spraying is higher than the stroke length, the at least one spray nozzle, after spraying of a width with a determined number of strips, is displaced substantially through the stroke length in the first direction, whereafter a subsequent width is sprayed with a number of substantially parallel strips. This displacement is here advantageously so great that edge parts of strips in adjacent widths at least

partially overlap each other, preferably such that the at least partially mutually overlapping edge parts undergo the same spraying treatment as other parts of the strips.

According to a second aspect of the invention the method is characterized in that suction means for extracting a mist created during spraying are co-displaced with the at least one spray nozzle. In this manner the spray mist cannot escape and there is the least possible impact on the environment.

The extracted spray mist is herein preferably separated into a contaminated and a clean fraction. The contaminated fraction can then be discharged or processed in simple manner, while the clean fraction can be blown out into the ambient or reused.

In order to prevent undesired spread of the spray mist, a curtain of a gas blown out under pressure is preferably formed around the at least one spray nozzle.

The invention also relates to a device for performing the above described method. Such a spraying device is characterized according to the invention by at least one spray nozzle, means for causing the spray nozzle to move through a determined stroke length in a first direction along the surface and means for causing the at least one spray nozzle, at least at the end of the stroke length, to move along the surface in a second direction enclosing an angle with the first direction.

A structurally simple spraying device is obtained when the means for moving the spray nozzle(s) in the second direction comprise a vehicle, on which are arranged the means for moving the spray nozzle(s) in the first direction. The means for moving the spray nozzle(s) in the first direction herein advantageously comprise at least one carrier for the spray nozzle(s) movable along a guide path. A well-guided movement of the spray nozzle(s) is thus ensured.

The spraying device advantageously also has means connected to the carrier for driving thereof, for instance in the form of at least one endless drive member connected to the carrier and trained over a

number of discs placed at a mutual distance in the first direction. Using such an endless drive member, for instance a toothed belt or a chain, the spray nozzles can be moved reciprocally in simple manner. In order to be able to follow the movement of the drive member over the discs the carrier is preferably connected thereto via a connecting element displaceable therealong transversely of the first direction.

When the carrier is elongate and movable along a support element, the carrier itself determines the guide path.

In order to ensure a uniform treatment at the end of the stroke length, the spraying device is preferably provided with means for moving the spray nozzle(s) in a third direction at the end of the stroke length. A structurally simple solution is herein obtained when these means for moving the spray nozzle(s) in the third direction are adapted to cause pivoting of at least a part of the carrier.

In another embodiment of the spraying device according to the invention the spray nozzle is carried by at least one movable arm which is arranged on a mobile vehicle, wherein between the spray nozzle and the arm are accommodated means for compensating movements of the arm. By making use of a mobile vehicle the spray nozzle of the spraying device can be displaced relatively rapidly along the surface for spraying, thereby achieving a high productivity. The compensation means herein ensure that the spray nozzle is moved evenly along the surface under all conditions.

A properly operating spraying device is obtained when the compensation means comprise a movable suspension which has at least one spring, is mounted on the arm and carries the spray nozzle. The spring is herein preferably a gas spring which is robust and readily adjustable. In order to keep the spring stiffness of this spring practically constant in the case of differences in the position of the arm and associated variations in the degree of compression, the

spraying device advantageously has a supply barrel connected to the gas spring.

In order to make the spray nozzle follow the desired path at all times, the compensation means preferably comprise a control system connected to the suspension. The control system is herein advantageously connected to the gas spring in controlling manner. A simple control is obtained when the control system is adapted to hold the spray nozzle within a width defined by two end points. In order to enable control of the spray nozzle during both a forward and return stroke, the control system is preferably reversible.

In order to reduce the environmental impact of the use of a spraying device, particularly a spraying device of the above described type, it is preferably provided with means connected to the spray nozzle(s) for extracting a mist created during use of the device. These suction means may simply comprise a hood at least partially enclosing the spray nozzle(s). In this case the carrier and/or the hood is preferably provided with means for guiding thereof along the surface for spraying, whereby the spray nozzles can be held at the desired distance from the surface for spraying. The guide means can herein comprise at least two guide rollers placed outside the reach of the spray nozzle(s), thus preventing the guide means coming into contact with the treated part of the surface. Conversely, the guide means can also comprise at least one distance measuring device, whereby any contact between the guide means and the surface for spraying is avoided.

The spraying device is further preferably provided with means connected to the suction means for separating the extracted spray mist into a contaminated and a clean fraction, whereby the extracted mist can immediately be made suitable for discharge and further processing or for reuse.

A very good and effective separation is obtained here when the separating means comprise at least one rotatable member received in a closed housing. The spray mist can hereby be as it were centrifuged, so that the

particles present therein are flung outward and relatively clean air remains. For discharge of the particles removed by centrifuging the housing advantageously has at least one at least partially inclining wall and a discharge opening arranged therein. The housing preferably also comprises a number of concertina-shaped, mutually connected chambers, in each of which is received a rotatable member. A number of separation stages are thus in fact formed.

In a preferred embodiment the spraying device further comprises means for forming around the spray nozzle(s) a curtain of gas blown out under pressure, whereby the spray mist is as it were "confined" and spreading thereof is prevented. The curtain-forming means herein advantageously comprise at least one outlet opening for the gas arranged in the vicinity of the spray nozzle(s). When the spraying device comprises suction means in the form of an extraction hood, the outlet opening(s) is/are preferably arranged in the hood.

When at least some of the outlet openings are adapted to carry ambient air, an impenetrable curtain can still be formed with a relatively small amount of blown-out gas. Use can advantageously be made herein of the so-called "Coanda" effect.

The hood preferably takes a double-walled form and outlet openings are arranged along both walls, whereby it is even possible to form a double curtain. When the outlet openings along the inner and outer wall of the hood are then directed at different angles relative to the surface for spraying, the two "layers" of the double curtain can force each other into the space between the two walls. For separation of the collected spray mist at least one filter can be further arranged in a space defined by the double wall of the hood.

Finally, the invention further relates to a hood evidently intended for use in a spraying device as described above.

The invention will now be elucidated on the basis of a number of embodiments, wherein reference is made to

the annexed drawing, in which corresponding components are designated with reference numerals increased each time by "100", and in which:

Fig. 1 shows a perspective view of a spraying device according to a first embodiment of the invention,

Fig. 2 shows a perspective view from a different angle of a part of the means for moving the spray nozzles and the suction means of the spraying device of fig. 1,

Fig. 3 is a detail view according to arrow III in fig. 2,

Fig. 4 shows a part of the detail of fig. 3 with exploded components,

Fig. 5 is a partly cross-sectional perspective view of the separation means of the spraying device,

Fig. 6 is a schematic cross-section through a paint layer obtained with the spraying device according to the invention,

Fig. 7 is a schematic view of a first spraying pattern with single coating obtained by applying the method according to the invention,

Fig. 8 is a schematic view of another pattern with a double coating,

Fig. 9 shows schematically the different steps of the movement of a spray nozzle at the end of the stroke length,

Fig. 10 shows a schematic view of a second embodiment of the spraying device according to the invention,

Fig. 11 shows schematically a ship being treated by a third embodiment of the spraying device according to the invention,

Fig. 12 shows a perspective view on enlarged scale of the spraying device of fig. 11,

Fig. 13 is a perspective detail view according to arrow XIII in fig. 12,

Fig. 14 shows a schematic cross-section through the hood of the spraying device,

Fig. 15 is a schematic perspective view of the spraying operation during use of a spraying device according to a fourth embodiment of the invention,

Fig. 16 shows a cross-section corresponding with Fig. 14 through a hood with means for forming a gas curtain,

Fig. 17 shows schematically a part of a ship being treated by a spraying device according to a fifth embodiment of the invention,

Fig. 18 is a perspective view on enlarged scale according to arrow XVIII in fig. 17, in which the compensation means are shown,

Fig. 19 shows schematically the most important components of the compensation means for the spraying device of fig. 17 and 18,

Fig. 20 shows schematically the operation of the control system for the spray nozzle of the spraying device of fig. 17 and 18,

Fig. 21 is a schematic cross-sectional view of a part of the spray nozzle, in which the formation of the protective curtain is elucidated, and

Fig. 22 shows schematically a detail of an outlet opening applied in the forming of the curtain.

A device 1 for spraying a surface 2, for instance a ship's hull (fig. 1), is provided with a number of (in the embodiment shown here three) spray nozzles 3 (fig. 2), means 4 for moving spray nozzles 3 in a first direction V along ship's hull 2, and means 5 for moving spray nozzles 3 therealong in a second direction H. The means 5 for moving spray nozzles 3 in the second or horizontal direction H are here formed by a vehicle 6 which can travel along rails 8 by means of wheels 7. Vehicle 6 can be provided for this purpose with its own drive motor 60, but it is also conceivable for it to be moved by for instance cables or the like.

The means 4 for moving spray nozzles 3 in the first or vertical direction V comprise a telescopic arm 9 on the one hand and, suspended pivotally therefrom by means of a hinge 10 acting in different directions, a moving mechanism 11 carrying spray nozzles 3 on the other. This

moving mechanism 11 is received inside a hood 12 which is likewise carried by the telescopic arm and forms part of the suction means to be discussed hereinbelow. Using telescopic arm 9 the moving mechanism 11 with spray nozzles 3 can be carried up or downward each time through a stroke length of this mechanism when a horizontal width of ship's hull 2 has been treated.

The telescopic arm 9 is operated by a conventional drive which is arranged on vehicle 6 and which forms no part of the invention and is not further shown or elucidated here. Further arranged on vehicle 6 is a compressor 13, whereby the fluid for spraying can be brought under pressure. Several barrels 14 of paint are also shown from which the spray nozzles 3 are fed over a line 15. Also situated on vehicle 6 is a suction pump 16 which is connected to hood 12, in addition to separating means 17, in the embodiment shown here in the form of a simple cyclone, whereby an extracted spray mist can be separated into a contaminated and a clean fraction.

In the shown embodiment the hood 12 is further provided with means 18 for guiding spray nozzles 3 along surface 2. These guide means 18 can comprise two guide rollers 19 placed along the lower edge of hood 12 and a guide roller 20 placed roughly halfway along hood 12 on the front side thereof as viewed in the direction of movement (fig. 1). Because spray nozzles 3 will normally be moved from top to bottom along the ship's hull 2, this placing of guide rollers 19, 20 ensures that they run over parts of surface 2 which have not yet been treated.

In another variant the guide means 18 are formed by sensors 21 arranged on the corners of hood 12, whereby the distance of hood 12 from the surface 2 for treating is determined (fig. 2). These sensors 21 then control the movement of telescopic arm 9 such that the distance between spray nozzles 3 and surface 2 is held constant.

The mechanism 11 whereby the spray nozzles are moved in the first, vertical direction V along the surface 2 for spraying, comprises a carrier 22 which is guided along two rails 24 by means of four wheels 23

(fig. 4). These rails 24 form part of a hat-shaped profile 25 in which drive means 26 for carrier 22 are arranged (fig. 3). These drive means 26 comprise an endless toothed belt 27 which is trained around two toothed discs 28, one of which is driven. Belt 27 is further provided with a central spine 29 and the toothing of discs 28 takes a divided form, thereby preventing belt 27 from running off discs 28. Return pulleys 28 are mounted in a sub-frame 30 which is fixed in hat-shaped profile 25.

Fixed onto belt 27 is a shaft stub 31, one end of which is mounted for rotation in a sliding plate 32. This sliding plate 32 is in turn mounted for sliding in carrier 22 such that shaft stub 31 can move in transverse direction relative to the carrier 22 when it passes over return pulley 28. On the other end of shaft stub 31 is suspended a counterweight 33, whereby the weight of carrier 22 is held in balance with spray nozzles 3 and a well-balanced construction is obtained. Also advantageous here is the fact that driving takes place by means of an endless belt 27, because the movement of carrier 22 is hereby decelerated and accelerated again in sinus-shaped manner at the end of its stroke, which results in a very uniform load on the construction.

Spray nozzles 3 are mounted on an arm 34 which is rotatably mounted in two bearing supports 35 arranged on carrier 22. Each spray nozzle is provided with a spraying orifice 36 and a connecting piece 37 which can be connected to a conduit (not shown here) for the supply of a mixture of the fluid for spraying (paint, washing liquid, blasting grit) and air or another carrier gas under pressure. Arranged on arm 34 are two toothed wheels 38, 39 with oppositely directed freewheel mechanism, which form part of means 40 for moving or pivoting spray nozzles 3 in a third direction R at the end of their stroke. These pivoting means 40 further comprise on both the upper and lower side of hat-shaped profile 25 two gear racks 41, 42 of different length arranged on either side thereof.

When now the shaft stub 31 approaches a return pulley 28, the one toothed wheel 38 comes into engagement with the longest gear rack 41, and arm 34 with spray nozzles 3 is hereby rotated through a determined angle of for instance 55° (fig. 9B). The spray pattern of each spray nozzle 3 is hereby distributed over a larger area, whereby a gradual decrease in the layer thickness is in fact obtained. At the end of the pivoting movement the supply of the mixture to spray nozzles 3 is also interrupted. At the end of the pivoting movement the other toothed wheel 39 will engage in the other, short gear rack 42, and will rotate freely round arm 34 as a result of its freewheel mechanism. After passing over return pulley 28 the second toothed wheel 39 will be rotated in the opposite direction by the short gear rack 42, while co-displacing the arm 34 with spray nozzles 3. The other toothed wheel 38 will herein now co-rotate freely. Spray nozzles 3 are thus pivoted back again. Because gear rack 42 is shorter than gear rack 41, the angle through which spray nozzles 3 are pivoted back also becomes smaller, for instance in the order of 35° (fig. 9C). The result of the pivoting movement described here is that spray nozzles 3 are moved reciprocally in the first direction in as it were a "tracking" or pulling manner, which means that as viewed in the direction of movement the nozzles spray to the rear at a small angle of for instance 10° (fig. 9A and 9C).

Spray nozzles 3 are arranged on arm 34 at interspacing such that together they can spray a layer of uniform nominal thickness t onto surface 2. Each spray nozzle 3 has a spray pattern which is somewhat thinly spread towards the edges, but the hereby occurring decrease in the layer thickness is compensated by the mutual overlap of the central spray nozzle 3 with the two outer spray nozzles 3 (fig. 6). The layer thickness is however limited on the edges 44 of the strip 43 formed by spray nozzles 3. To compensate for this the spraying device 1 is displaced through a distance d in the second direction of travel H such that

for instance the left edge 44L of a preceding strip 43 overlaps with the right edge 44R of a subsequent strip 43' (fig. 7). An almost perfectly uniform layer thickness is thus obtained. (This is of course also the case when not paint but for instance blasting grit is sprayed onto surface 2, albeit that instead of the layer thickness it is the degree of application which then becomes uniform.)

In order to achieve a constant layer thickness not only per width 45 of adjacent strips 43, but also between two widths 45 lying one above the other, spray nozzles 3, after completing a width 45, are displaced through slightly more than a stroke length g in the first direction. The upper edge 44U of a strip 43 in a width 45' lying below will hereby overlap with a lower edge 44L of a strip in a width 45 situated thereabove, whereby the decrease in the layer thickness is again compensated.

The shown pattern relates to a single layer, which is formed in that the spray nozzles have only been active during one of the movements, usually the downward movement. The progression of the strips 43 obliquely downward is herein the result of the fact that spraying device 1 is moved continuously in both the first direction V and the second direction H. When a greater, for instance double, layer thickness is desired, spray nozzles 3 can operate in both directions, thereby forming the W-shaped spraying pattern shown in fig. 8.

In an alternative embodiment of the invention (Fig. 15) spray nozzles 303 are arranged staggered in two directions. A considerable degree of overlap between the strip 343 covered by these spray nozzles can hereby be obtained, without the spray cones of spray nozzles 303 unduly interfering with each other. A relatively thick layer can thus be applied to surface 302 in a single operating run.

As stated, the hood 12 forms part of the suction means, which further comprise a suction pump 16. Hood 12 is connected to this pump 16 by a suction conduit (not shown here). Hood 12 takes a double-walled form, with an

outer wall 70 and an inner wall 71, between which is defined an extraction space 72 connected to pump 16 (fig.14). An underpressure is thus created in extraction space 72 by suction pump 16, whereby ambient air is drawn in which forms as it were an "air curtain" 73, which extends from the edge of the hood 12 to the surface 2 for spraying, and by which the spray mist is as it were confined. Through this confinement and continuous extraction of the spray mist, in which for instance remnants of paint and solvents, or minuscule blasting grit particles may be situated, this mist is prevented from being released into the atmosphere. The working conditions for operatives are hereby improved and there is less impact on the environment.

In yet another embodiment (fig. 16) a curtain 473 surrounding the spray nozzle(s) is formed by blowing out air under pressure through a number of openings 474 in hood 412. This air herein flows along all inner walls 471 and is extracted again to space 472. The airflow is hereby forced to turn very sharply, wherein (paint) particles possibly present therein as it were "go off the road" and contact the surface 402. As a result virtually no particles are extracted, so that the separation system is relatively lightly loaded and will hardly be contaminated. The life-span of the different components of the separation system is thus considerably increased.

An embodiment which is recommended at this time has a double air curtain 573i, 573o, which is blown out through outlet openings 574i, 574o along the inner wall 571 and outer wall 570 of the hood 512 having the spray nozzles(s) therein (Fig. 21). The inner air curtain 573i herein encloses a more acute angle ß with surface 502 than the outer air curtain 573o, whereby the two air curtains 573i, 573o, when they meet each other after being blown against surface 502, deflect inward and therein flow from the surface 502 to the space 572 in hood 512. Because the inner curtain 573i flows more parallel to surface 502, the speed thereof can be lower, whereby the static pressure at the location of this

curtain remains slightly lower, and not too much spray mist is therefore drawn to the outside of hood 512. As stated, the spray mist is as it were confined within the periphery of hood 512 by the double air curtain 573i, 573o, whereby there is less impact on the environment and at the same time more efficient use is made of the sprayed medium.

In order to create a relatively thick and effectively acting curtain, at least some of the outlet openings, for instance the outlet openings 547o along outer wall 571 of hood 512, can be adapted to co-displace a considerable amount of ambient air. For this purpose the air curtain 574o must be guided along at least a part of outer wall 570 at high speed, wherein a low pressure prevails because of the high speed in the blown-out airflow, whereby the ambient air is entrained. Blowing the curtain 574o at high speed along the surface of outer wall 571 can be achieved by making use of the so-called "Coanda effect", whereby a gas or air flow blown out in the vicinity of a surface as it were adheres to this surface.

In the shown embodiment the air is blown out under pressure through openings 575 which debouch in a chamber 576 formed in outer wall 571 of hood 512 (fig. 22). This chamber 576 is defined for instance by a U-shaped component 577 and a cover plate 578 placed a small distance w thereabove. The actual outlet opening 574o is formed by the intermediate distance w defined by a foil 579 of the same thickness arranged between component 577 and plate 578. Immediately adjacently of outlet opening 574o the outer wall 571 has a curved part 570c to which the blown-out air curtain 573o adheres. Due to the speed at which air curtain 573o is blown out, and the underpressure associated therewith, ambient air is drawn in as according to arrow A and an extra-thick air curtain is thus created.

Further connected to the suction means are separation means 17. Instead of the cyclone shown in fig. 1, these separation means 17 may also comprise a centrifugal separator 46 with rotating discs 47 (fig.

5). The rotating discs 47, each having a number of curved guide edges 48, are herein accommodated in a chamber 49 of a concertina-shaped inner housing 50. Discs 47 are driven for rotation by a common shaft 59. The lower wall 51 of each chamber 49 is disposed obliquely and has an annular outlet opening 52 along the low-lying inner edge thereof. Upper wall 53 of each chamber 49 is also arranged obliquely. Inner housing 50 is received in an outer housing 54 which is provided with a collecting gutter 56 debouching in a discharge opening 55. Inner housing 50 is connected at its top and bottom with central feed and outfeed channels 57, 58, wherein outfeed channel 58 is connected to pump 16 of the suction means.

The operation of the separation means is now as follows. Spray mist extracted by the suction means enters the top of the first chamber 49 through the central feed tube 57 and is there accelerated in radial direction by rotating disc 47. As a result of the centrifugal forces occurring herein, the relatively heavy particles present in the mist are flung against the outer wall of chamber 49, whereafter they flow along the lower wall 51 to outlet opening 52, and therefrom along the upper wall 53 of the following chamber 49 to the outside, where they drip into collecting gutter 56. Particles which have not yet been separated from the mist in the first chamber are carried along to the second chamber, and there subjected once again to an acceleration. In each stage of separator 46 further contaminants are thus removed from the mist until eventually a relatively clean mist is blown outside through discharge channel 58. The effectiveness of the different stages can be further varied herein by adapting the dimensions of discs 47 and the shape of guides 48.

In another embodiment of spraying device 101 according to the invention the means 105 for moving the spray nozzles (not shown here) in the second direction H along the ship's hull 102 for spraying are formed by a free-travelling vehicle 106 (fig. 11). The means 104 for

moving the spray nozzles in the first direction V once again comprise a telescopic arm 109 and a moving mechanism 111 carrying the spray nozzles. Vehicle 106 with telescopic arm 109 can be a conventional boom truck. The moving mechanism 111 is again connected pivotally to telescopic arm 109 via a hinge 110 acting in different directions. Further arranged on the end of telescopic arm 109 is a first guide member 161 which is plate-like in the shown embodiment and can be provided with guide rollers (not shown here) with which guide member 161 is pressed against ship's hull 102 by telescopic arm 109. In this manner a stable starting position is created for the moving mechanism 111.

The moving mechanism 111 comprises an elongate carrier 122 which is arranged slidably in a U-shaped support element 125. The support element 125 is herein arranged pivotally on a spacer 163, which is in turn fixed on guide plate 161. Carrier 122 is provided with drive means 126, in the shown embodiment in the form of a motor which is connected to a movable drive element (not shown here), which in turn co-acts with a fixed drive element connected to support element 125. The movable drive element can for instance be a screw spindle rotated by the motor, wherein the drive element connected to support element 125 could be a nut engaging thereon. Other drives, for instance by means of belts or chains and discs or rollers co-acting therewith, can also be envisaged.

On the end lying opposite the motor the carrier 122 is provided with guide means 118, in the shown embodiment in the form of a plate 162 which is pivotable relative to the carrier by means of two hinges 164, 165 and on which a number of guide rollers (not shown here) can be arranged. It is also possible for other guide means 118 to be applied, for instance in the form of one or more sensors for determining the distance to the surface 102, which then co-act with either the telescopic arm 109 or a drive (not shown here) for pivoting support element 125. Carrier 122 in fact thus describes a curved path along support element 125 when

guide plate 162 is moved parallel to the surface 102 for treating.

Guide plate 162 supports on the top side an L-shaped arm 167 which is pivotable on a shaft 166 and which in turn carries the spray nozzles and hood 112. Hood 112 with the spray nozzles is here also pivotable relative to arm 167 such that the surface of hood 112 directed towards ship's hull 102 can be placed parallel to guide plate 162 and can be moved at a suitably chosen distance along surface 102. The position of hood 112 relative to guide plate 162 can herein be fixed once it has been adjusted.

Compared with the first embodiment of the spraying device 1, the spraying device 101 according to this embodiment has the particular advantage that due to the smaller dimensions of hood 112 the surface 102 for spraying can be followed at a shorter distance when it has inward or outward curving shapes.

In yet another embodiment of the device 501 for spraying the surface 502, the movements of the spray nozzle(s) (not shown here), again arranged within a protective hood 512, in the first and second direction V, H are once again provided entirely by the free-travelling vehicle 506 and the boom arm 509 mounted thereon (fig. 17). This arm 509 is pivotable on both a vertical axis Z and a horizontal axis X and is in addition telescopically adjustable in length as according to arrow Y. Arranged on the free end of arm 509 is a hood 512 with the spray nozzles(s) therein. This hood 512 having the spray nozzles(s) therein is not mounted directly on arm 509 but via a movable suspension 580, whereby movements of arm 509 can be compensated, so that the displacement of hood 512 with the spray nozzles(s) therein along a chosen path is not influenced thereby. This is important because the length of arm 509 is relatively great compared with the wheel base of vehicle 506, so that a small movement of vehicle 506, for instance as a result of driving over an uneven surface, is translated into a relatively great distance travelled by the free end of arm 509.

Suspension 580 is formed by a straight guide rail 525 which is directed substantially transversely of the longitudinal axis of arm 509 and along which a carriage 522 bearing the hood 512 is movable to compensate the movement of the free end of arm 509. The path travelled by this free end will after all describe a roughly circular movement around the mounting point of arm 509 on vehicle 506, wherein the radius of the circle corresponds to the length of arm 509 and is therefore so large that with small angular displacements the circle segment can be approximated by a straight line transversely of arm 509. The carriage 522 having mounted thereon the hood 512 with the spray nozzles(s) therein is held at a fixed position relative to guide rail 525 by a spring 526, which compensates the component, directed along rail 525, of the weight of hood 512 with the spray nozzles(s) therein and the carriage 522. This spring 526 must have relatively little stiffness, so as to be able to react even in the case of a slight movement of arm 509. A gas spring has been chosen in the shown embodiment. Because, when a gas spring is compressed, the spring constant thereof changes relatively sharply as a result of the change of volume and therewith the change of pressure of the gas present in spring 526, a storage barrel 527 of much greater volume is connected to gas spring 526 (fig. 19). The total gas volume in the system of spring 526 and barrel 527 hereby remains practically constant even in the case of strong compression of spring 526, whereby the properties of gas spring 526 also remain practically constant. This is important because when there is a change in the height of arm 509 due to rotation thereof round horizontal axis H, the component of the weight of hood 512 with the spray nozzles(s) therein can vary considerably along the rail 525.

Since the hood 512 with the spray nozzles(s) therein is not directly connected to arm 509, a control system 581 is present, whereby the hood 512 with the spray nozzles(s) therein is actively held within a chosen width, which is defined by two end points 582 on

guide rail 525. In this embodiment the control system 581 is connected to four controllable guides or wheels 519, 520 which are arranged on the hood 512 with the spray nozzles(s) therein and of which three move along the surface 502 for spraying at a time (fig. 20). The hood 512 with the spray nozzles(s) therein is moved in this embodiment over surface 502 in horizontal strips, wherein a start is made at the top side of surface 502 and the operation subsequently moves downward. The two lower wheels 519 herein always make contact with the part of surface 502 which has not yet been sprayed, as does the leading one of the two upper wheels 520 as viewed in the direction of displacement. The other upper wheel 520, which for the sake of clarity has been entirely omitted from Fig. 18, is herein retracted.

The control system 581, which can take a pneumatic or hydraulic form, comprises two sensors at both end points 582, which are each formed by a 3/2-valve 583. These two valves 583 are connected in turn to a 5/2-valve 584 which serves to enable reversing of the operational direction of control system 581, when the displacement direction of hood 512 with the spray nozzles(s) therein is reversed. The initially extended upper wheel 520 is herein retracted and the retracted wheel 520 is extended again. The reversing valve 584 is connected to two 5/2-valves 585 which are each connected to one side of a double-action cylinder 586. This cylinder 586 is in turn connected in controlling manner to the three wheels 519, 520 active at that moment by means of for instance a transmission with three control rods 587 for thus controlling the movement of the hood 512 with the spray nozzles(s) therein.

When the sensor detects at one of the end points 582 that carriage 522 has reached the end point, the associated valve 583 is thereby actuated, whereby the three wheels 519, 520 are controlled such that the hood 512 with the spray nozzles(s) therein is hereby driven transversely of the actual direction of displacement over the surface, so as to force the carriage 522 back to the centre of guide rail 525. Although the force with

which the hood 512 with the spray nozzles(s) therein is pressed against surface 502 by arm 509 is relatively small, the wheels 519, 520 still have sufficient grip to enable such a driving action. As soon as carriage 522 reaches the centre of rail 525, this is detected by a sensor arranged there, whereafter wheels 519, 520 are driven to their neutral position, and hood 512 with the spray nozzles(s) therein resumes its original path over surface 502. The movements of arm 509 are thus compensated by the resilient suspension 580 of hood 512 with the spray nozzles(s) therein, and the path of the hood 512 with the spray nozzles(s) therein is herein held between determined limits by control system 581.

In situations in which control by means of guide wheels 519, 520 is not practically feasible, for instance because wheels 519, 520 will have insufficient grip on the surface 502 for spraying, it is also conceivable for control system 581 to directly control the movement of carriage 522 along guide rail 525. For this purpose the control system 581 could for instance be connected in controlling manner to gas spring 526, which could then be embodied as double-action cylinder. The sensors at the end points 582 could in that case be connected to a single 5/2-valve, which could in turn be connected to the two sides of the double-action gas spring 526. Arrival at one of the end points 582 would thus result in gas spring 526 being pressed in or out, whereby carriage 522 would again be forced to the centre of guide rail 525.

In a simpler embodiment a single-action gas spring could be used, which could then be given a slightly "leaking" form, and could be connected to a source of gas under pressure. The gas spring will in that case move slowly downward under influence of the weight of the spray nozzle, whereafter on reaching the lower end point, after a signal of the sensor placed there, gas can be supplied under pressure to the gas spring. This supply of gas is then continued until the gas spring has moved the spray nozzle so far upward again that it reaches the upper end point, whereafter the gas supply

is closed off under control of the upper sensor and the spray nozzle will slowly descend again while simultaneously compressing the gas spring.

The above described spraying devices 1, 101, 501 enable treatment of a surface 2, 102, 502 in very uniform manner and with a minimal environmental impact.

Although the invention has been described above on the basis of a number of examples, it will however be apparent that it is not limited thereto. Thus, instead of a linear moving mechanism 11, 111, use could also be made of a swing arm 209, on which a carrier with spray nozzles could be mounted (fig. 10). With a suitable choice of the length of arm 209, the sprayed strips 243 could again run roughly parallel and in a practically straight line. In addition, instead of the shown driving by means of an endless belt, another type of reciprocally moving mechanism could be applied. Instead of the shown "tracking" method of spraying, a straight or even "pushing" method of spraying could be chosen.

While retaining most of the advantages associated therewith, the spraying device could be applied without the shown extraction and separation, while on the other hand this extraction and separation could also be applied in combination or each separately in conventionally moving spraying devices. The resilient suspension of the spray nozzle(s), which could also be achieved with types of spring other than the shown gas spring, and the associated control, which could likewise be embodied in different ways, could, while retaining the advantages obtainable therewith, be combined with many other spraying devices, both with and without extraction and separation.

The scope of the invention is therefore defined solely by the appended claims.

CLAIMS

1. Method for spraying a surface, **characterized by** causing at least one spray nozzle to move by mechanical means through a determined stroke length in a first direction along the surface and causing the at least one spray nozzle to move in a second direction along the surface at least at the end of the stroke length, wherein the first and second direction enclose an angle, this such that a spraying pattern is formed with substantially parallel strips running in the first direction.

2. Method as claimed in claim 1, **characterized in that** the at least one spray nozzle is moved reciprocally through the stroke length in the first direction.

3. Method as claimed in claim 2, **characterized in that** the at least one spray nozzle is active only during the forward stroke or the return stroke.

4. Method as claimed in any of the foregoing claims, **characterized in that** the at least one spray nozzle is moved continuously along the surface in both the first and the second direction.

5. Method as claimed in any of the foregoing claims, **characterized in that** the at least one spray nozzle is moved in the second direction such that edge parts of adjacent strips at least partially overlap each other.

6. Method as claimed in claim 5, **characterized in that** the at least one spray nozzle is moved in the second direction such that the at least partially mutually overlapping edge parts undergo the same spraying treatment as other parts of the strips.

7. Method as claimed in any of the foregoing claims, **characterized in that** the spraying is interrupted when the at least one spray nozzle reaches the end of the stroke length.

8. Method as claimed in any of the foregoing claims, **characterized in that** the at least one spray nozzle is moved in a third direction when it reaches the end of the stroke length.

9. Method as claimed in any of the foregoing claims, **characterized in that** the at least one spray nozzle, after spraying of a width with a determined number of strips, is displaced substantially through the stroke length in the first direction, whereafter a subsequent width is sprayed with a number of substantially parallel strips.

10. Method as claimed in claim 9, **characterized in that** the at least one spray nozzle is displaced in the first direction such that edge parts of strips in adjacent widths at least partially overlap each other.

11. Method as claimed in claim 10, **characterized in that** the at least one spray nozzle is moved in the first direction such that the at least partially mutually overlapping edge parts undergo the same spraying treatment as other parts of the strips.

12. Method particularly as claimed in any of the foregoing claims, **characterized in that** suction means for extracting a mist created during spraying are co-displaced with the at least one spray nozzle.

13. Method as claimed in claim 12, **characterized in that** the extracted spray mist is separated into a contaminated and a clean fraction.

14. Method as claimed in any of the foregoing claims, **characterized in that** a curtain of a gas blown out under pressure is formed around the at least one spray nozzle.

15. Device for spraying a surface, **characterized by** at least one spray nozzle, means for causing the spray nozzle to move through a determined stroke length in a first direction along the surface and means for causing the at least one spray nozzle, at least at the end of the stroke length, to move along the surface in a second direction enclosing an angle with the first direction.

16. Spraying device as claimed in claim 15, **characterized by** a plurality of spray nozzles arranged staggered in at least two directions.

17. Spraying device as claimed in claim 14, **characterized in that** the means for moving the spray nozzle(s) in the second direction comprise a vehicle, on

which are arranged the means for moving the spray nozzle(s) in the first direction.

18. Spraying device as claimed in any of the claims 15-17, **characterized in that** the means for moving the spray nozzle(s) in the first direction comprise at least one carrier for the spray nozzle(s) movable along a guide path.

19. Spraying device as claimed in claim 18, **characterized by** means connected to the carrier for driving thereof.

20. Spraying device as claimed in claim 19, **characterized in that** the drive means comprise at least one endless drive member connected to the carrier and trained over a number of discs placed at a mutual distance in the first direction.

21. Spraying device as claimed in claim 20, **characterized in that** the drive member is connected to the carrier via a connecting element displaceable therealong transversely of the first direction.

22. Spraying device as claimed in claim 18, **characterized in that** the carrier is elongate and movable along a support element.

23. Spraying device as claimed in any of the claims 15-22, **characterized by** means for moving the spray nozzle(s) in a third direction at the end of the stroke length.

24. Spraying device as claimed in claim 23, **characterized in that** the means for moving the spray nozzle(s) in the third direction are adapted to cause pivoting of at least a part of the carrier.

25. Spraying device as claimed in claim 15, **characterized in that** the spray nozzle is carried by at least one movable arm which is arranged on a mobile vehicle, wherein between the spray nozzle and the arm are accommodated means for compensating movements of the arm.

26. Spraying device as claimed in claim 25, **characterized in that** the compensation means comprise a movable suspension which has at least one spring, is mounted on the arm and carries the spray nozzle.

27. Spraying device as claimed in claim 26, **characterized in that** the spring is a gas spring.

28. Spraying device as claimed in claim 27, **characterized by** a supply barrel connected to the gas spring.

29. Spraying device as claimed in any of the claims 26-28, **characterized in that** the compensation means comprise a control system connected to the suspension.

30. Spraying device as claimed in claim 29, **characterized in that** the control system is connected in controlling manner to the gas spring.

31. Spraying device as claimed in claim 29 or 30, **characterized in that** the control system is adapted to hold the spray nozzle within a width defined by two end points.

32. Spraying device as claimed in any of the claims 29-31, **characterized in that** the control system is reversible.

33. Spraying device particularly as claimed in any of the claims 15-32, **characterized by** means connected to the spray nozzle(s) for extracting a mist created during use of the device.

34. Spraying device as claimed in claim 33, **characterized in that** the suction means comprise a hood at least partially enclosing the spray nozzle(s).

35. Spraying device as claimed in claim 34, **characterized in that** the carrier and/or the hood is provided with means for guiding thereof along the surface for spraying.

36. Spraying device as claimed in claim 35, **characterized in that** the guide means comprise at least two guide rollers or wheels placed outside the reach of the spray nozzle(s).

37. Spraying device as claimed in claim 35, **characterized in that** the guide means comprise at least one distance measuring device.

38. Spraying device as claimed in any of the claims 33-37, **characterized by** means connected to the suction means for separating the extracted spray mist into a contaminated and a clean fraction.

39. Spraying device as claimed in claim 38, **characterized in that** the separating means comprise at least one rotatable member received in a closed housing.

40. Spraying device as claimed in claim 39, **characterized in that** the housing has at least one at least partially inclining wall and a discharge opening arranged therein.

41. Spraying device as claimed in claim 39 or 40, **characterized in that** the housing comprises a number of concertina-shaped, mutually connected chambers, in each of which is received a rotatable member.

42. Spraying device as claimed in any of the claims 15-41, **characterized by** means for forming around the spray nozzle(s) a curtain of a gas blown out under pressure.

43. Spraying device as claimed in claim 42, **characterized in that** the curtain-forming means comprise at least one outlet opening for the gas arranged in the vicinity of the spray nozzle(s).

44. Spraying device as claimed in claims 34 and 43, **characterized in that** the outlet opening(s) is/are arranged in the hood.

45. Spraying device as claimed in claim 43 or 44, **characterized in that** at least some of the outlet openings are adapted to carry ambient air.

46. Spraying device as claimed in claim 44 or 45, **characterized in that** the hood takes a double-walled form and outlet openings are arranged along both walls.

47. Spraying device as claimed in claim 46, **characterized in that** the outlet openings along the inner and outer wall of the hood are directed at different angles relative to the surface for spraying.

48. Spraying device as claimed in claim 46 or 47, **characterized by** at least one filter arranged in a space defined by the double wall of the hood.

49. Hood evidently intended for use in a spraying device as claimed in any of the claims 34 to 48.

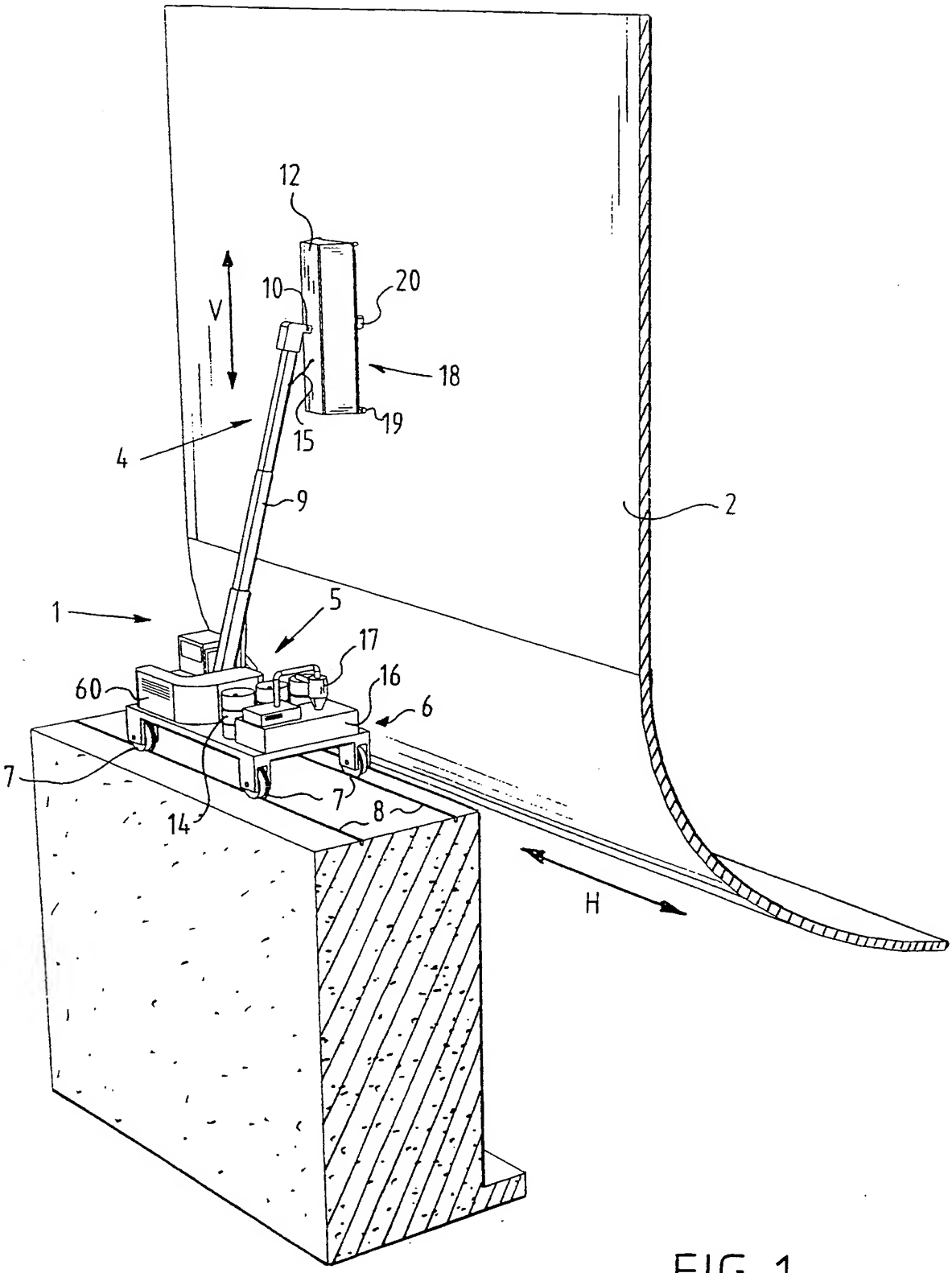


FIG. 1

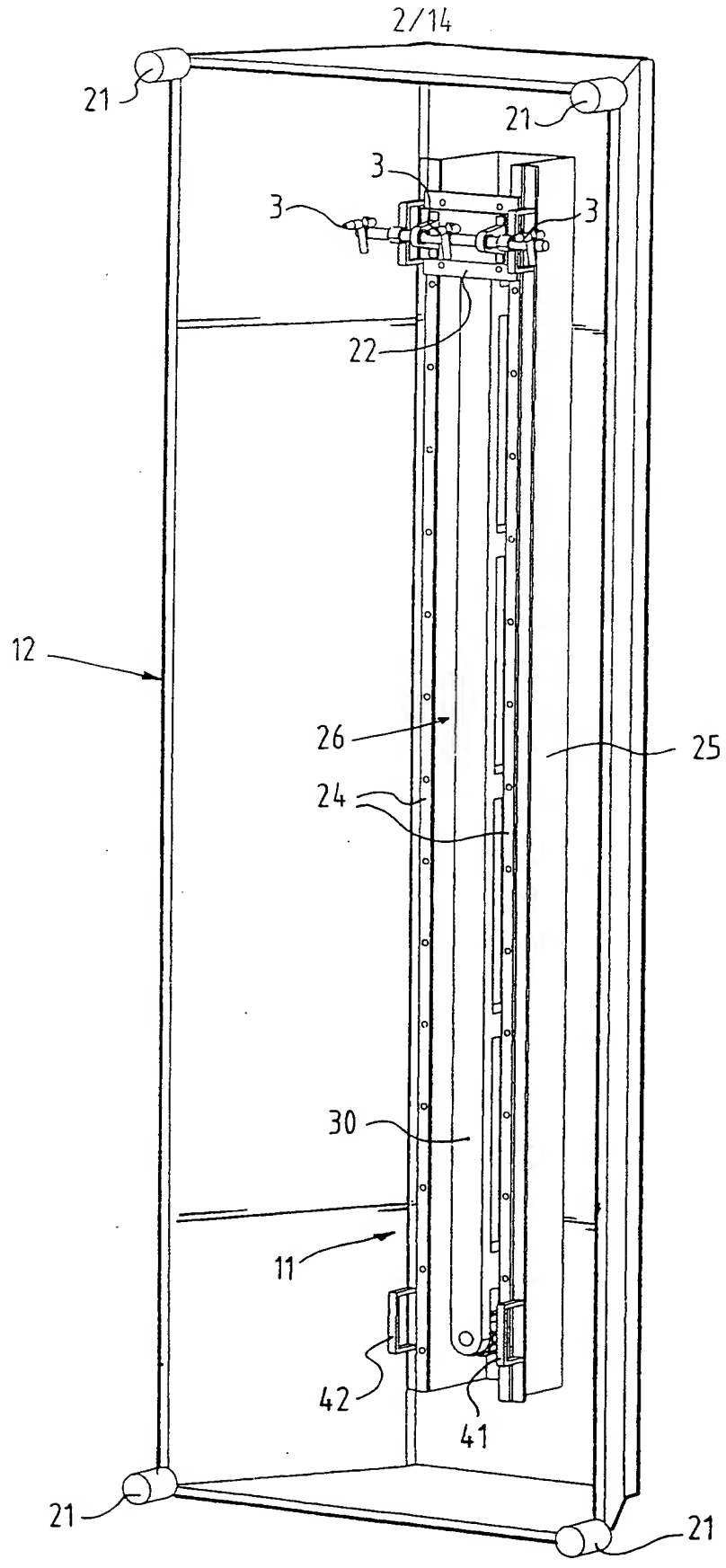


FIG. 2

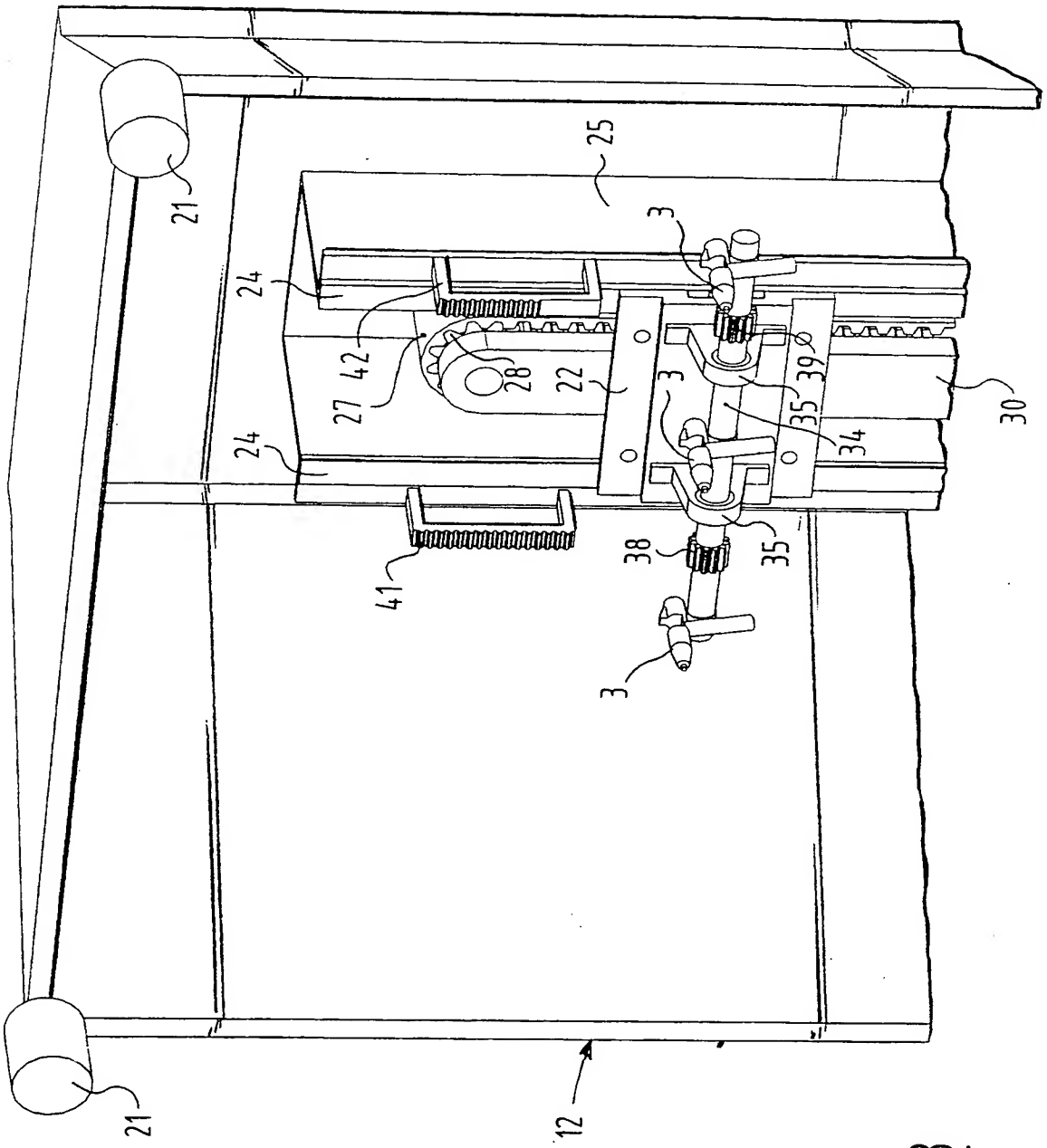


FIG.3

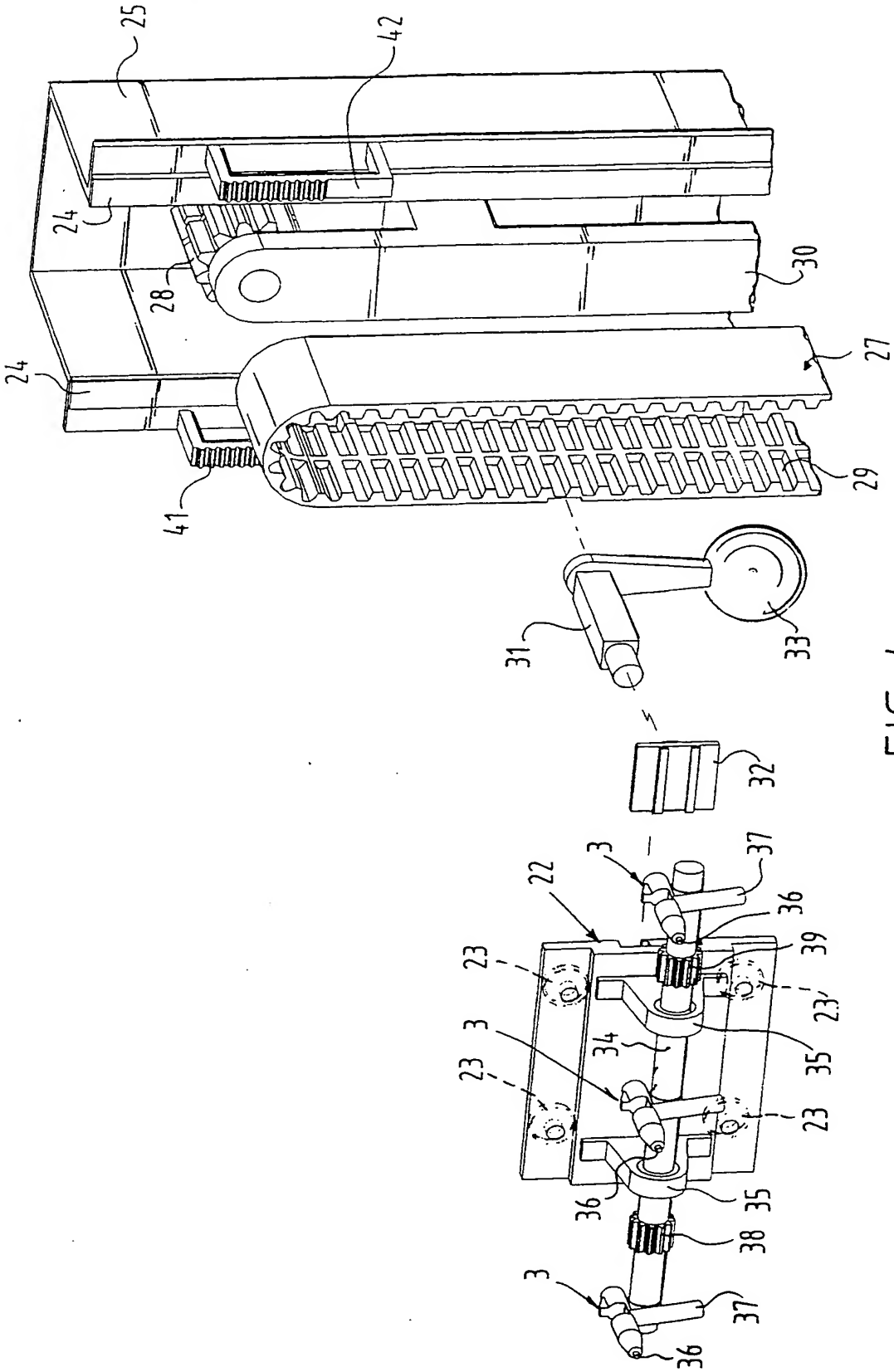

25
42
24
28
30
27
24
29
41
31
33
32
3
37
22
36
23
39
23'
3
34
35
23
23
36
35
38
3
37
36

FIG. 4

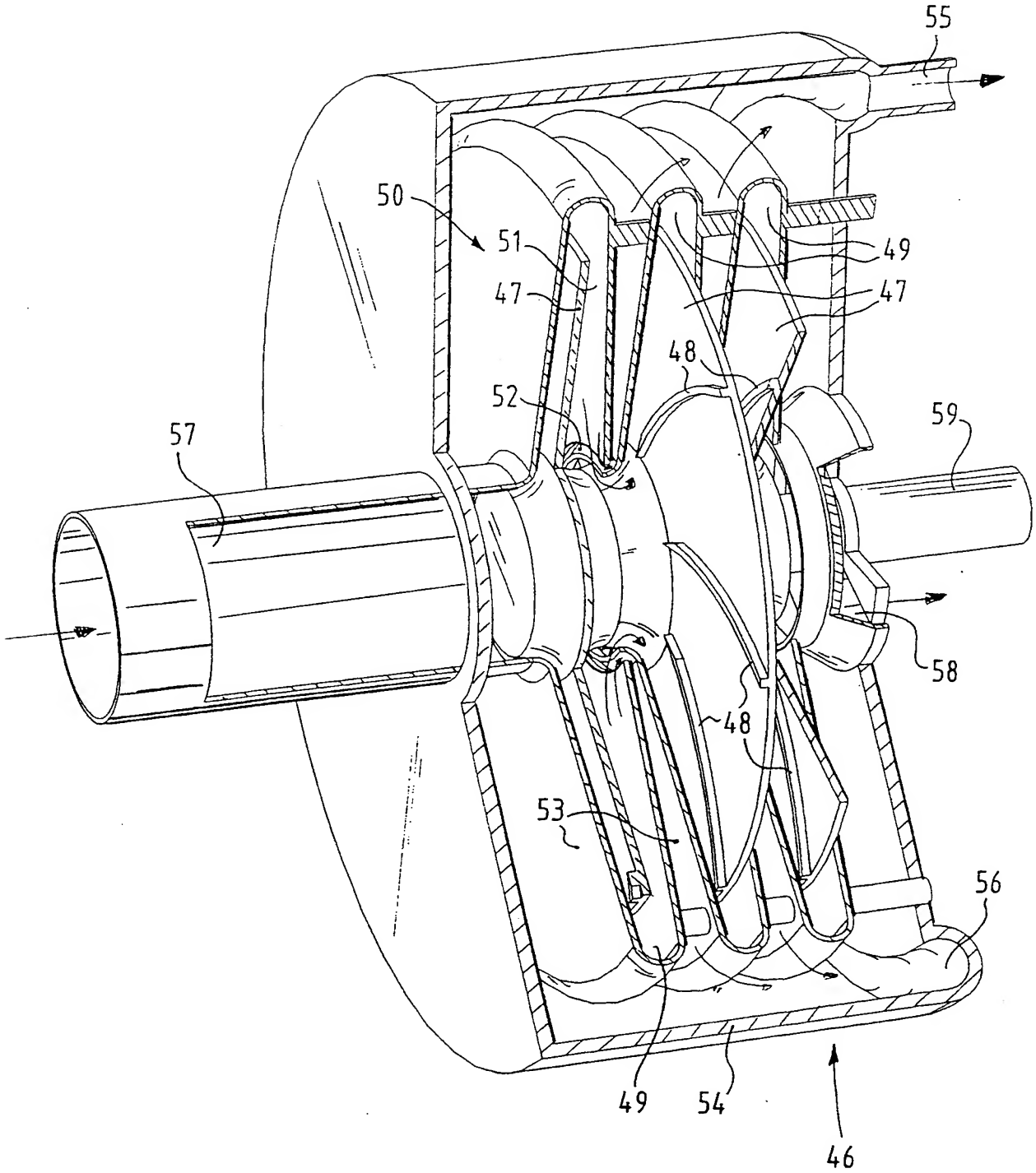


FIG. 5

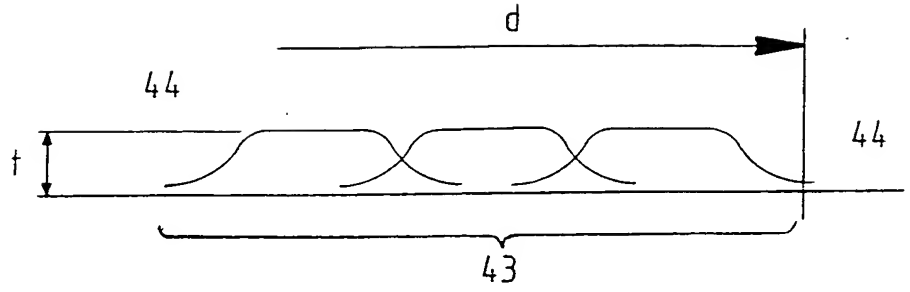


FIG. 6

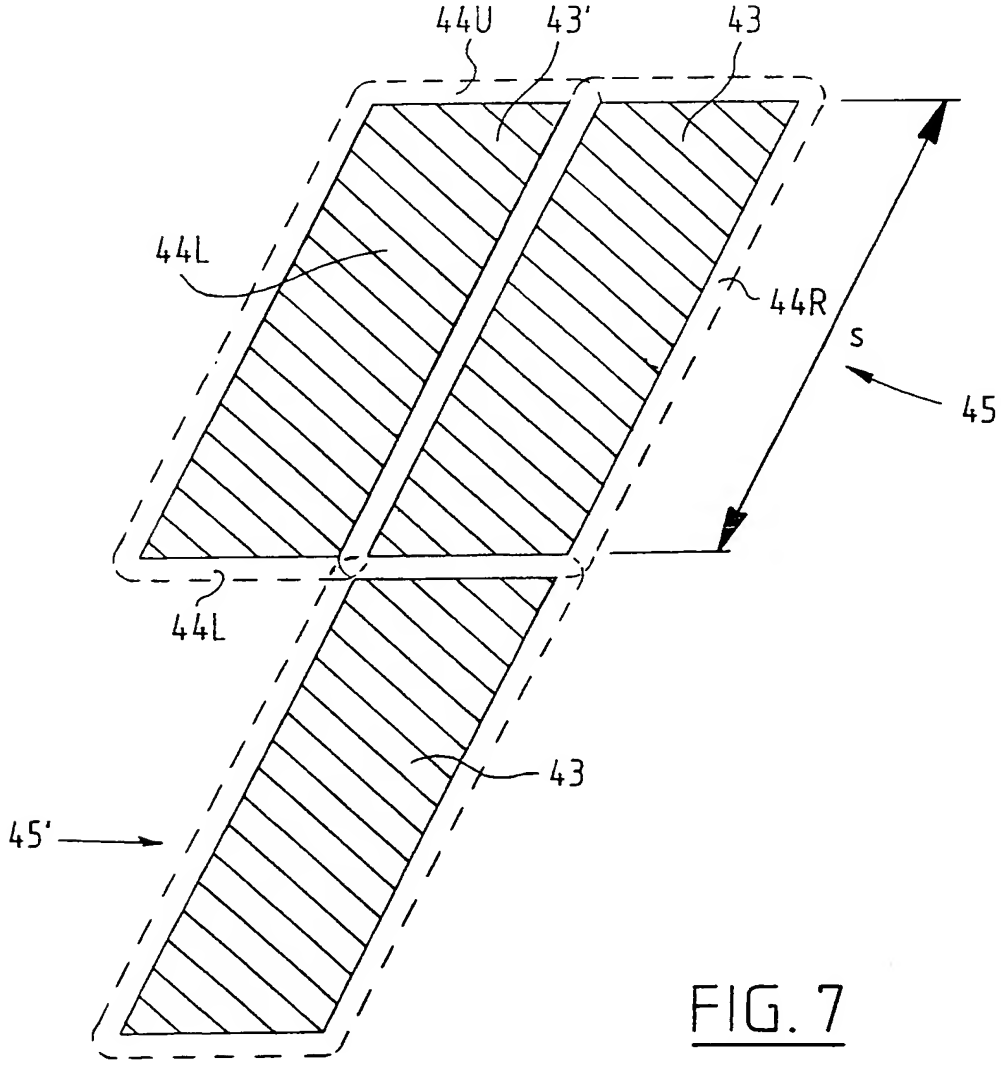


FIG. 7

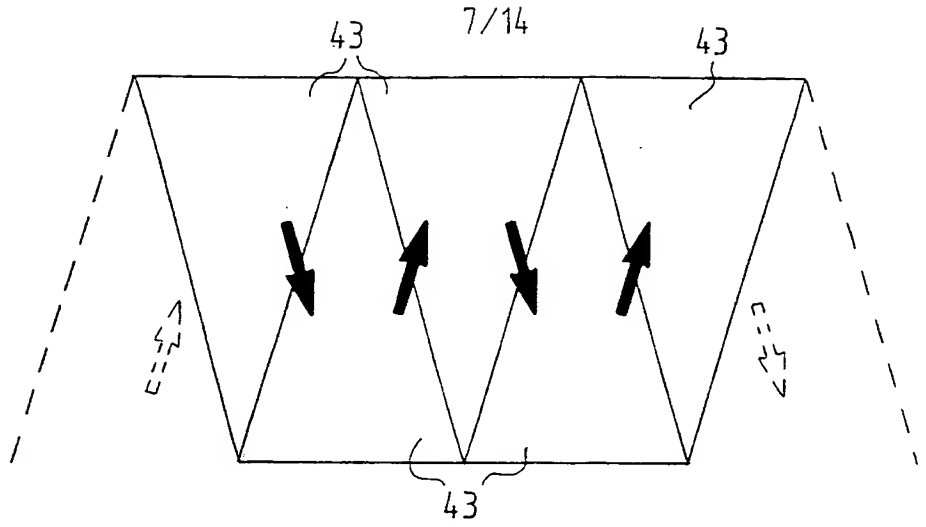


FIG. 8

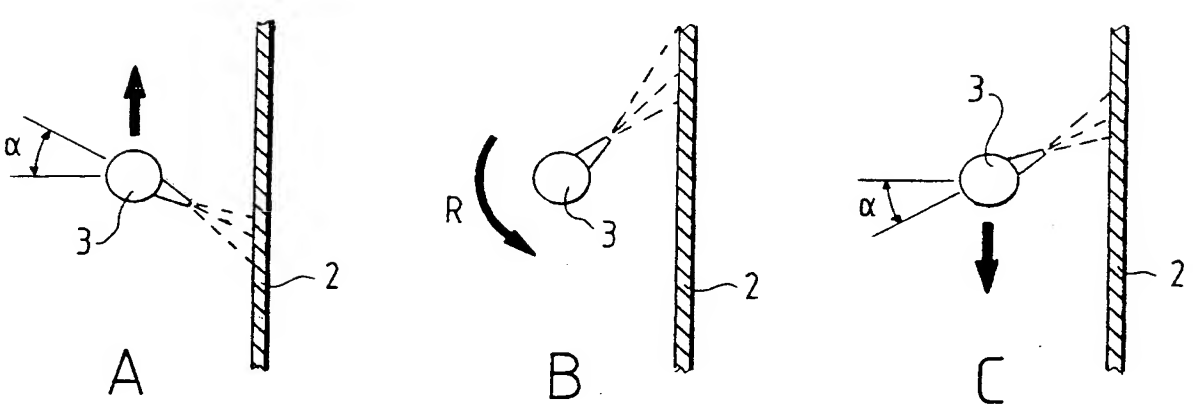


FIG. 9

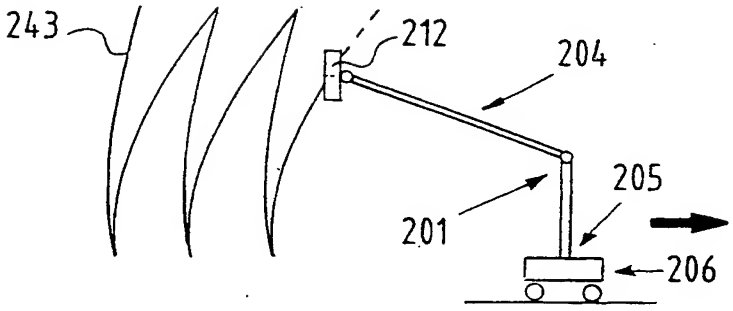


FIG. 10

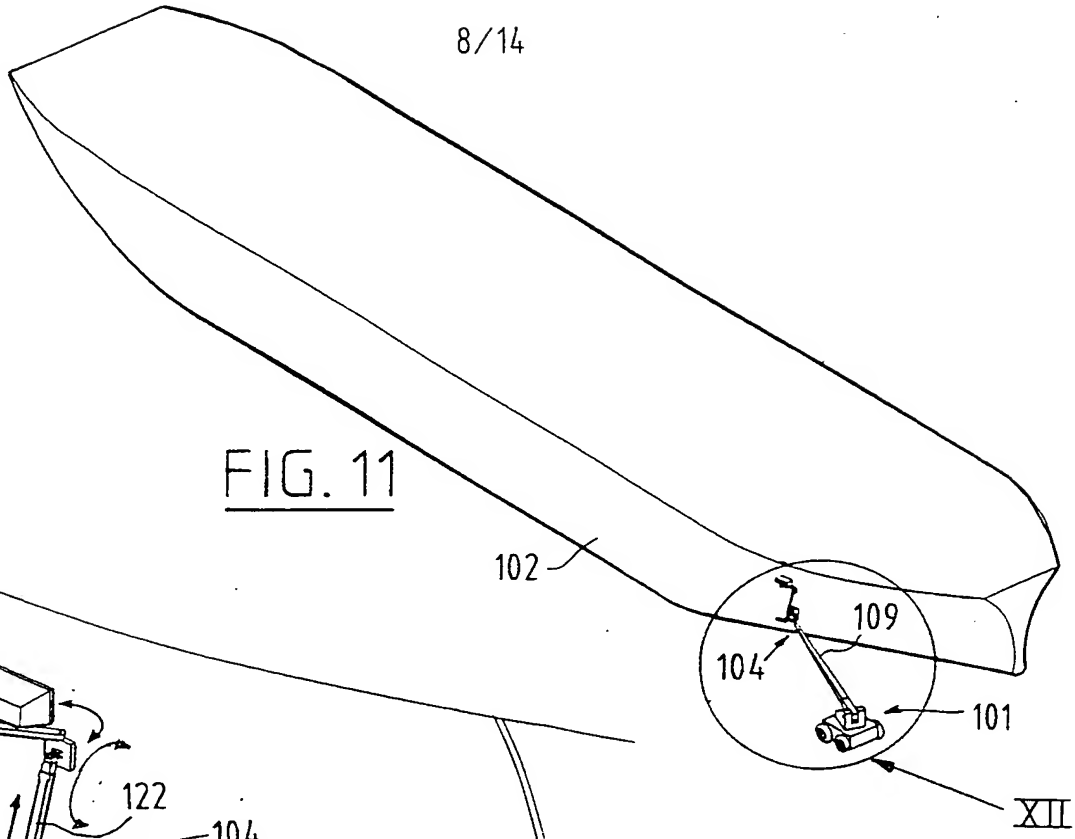


FIG. 11

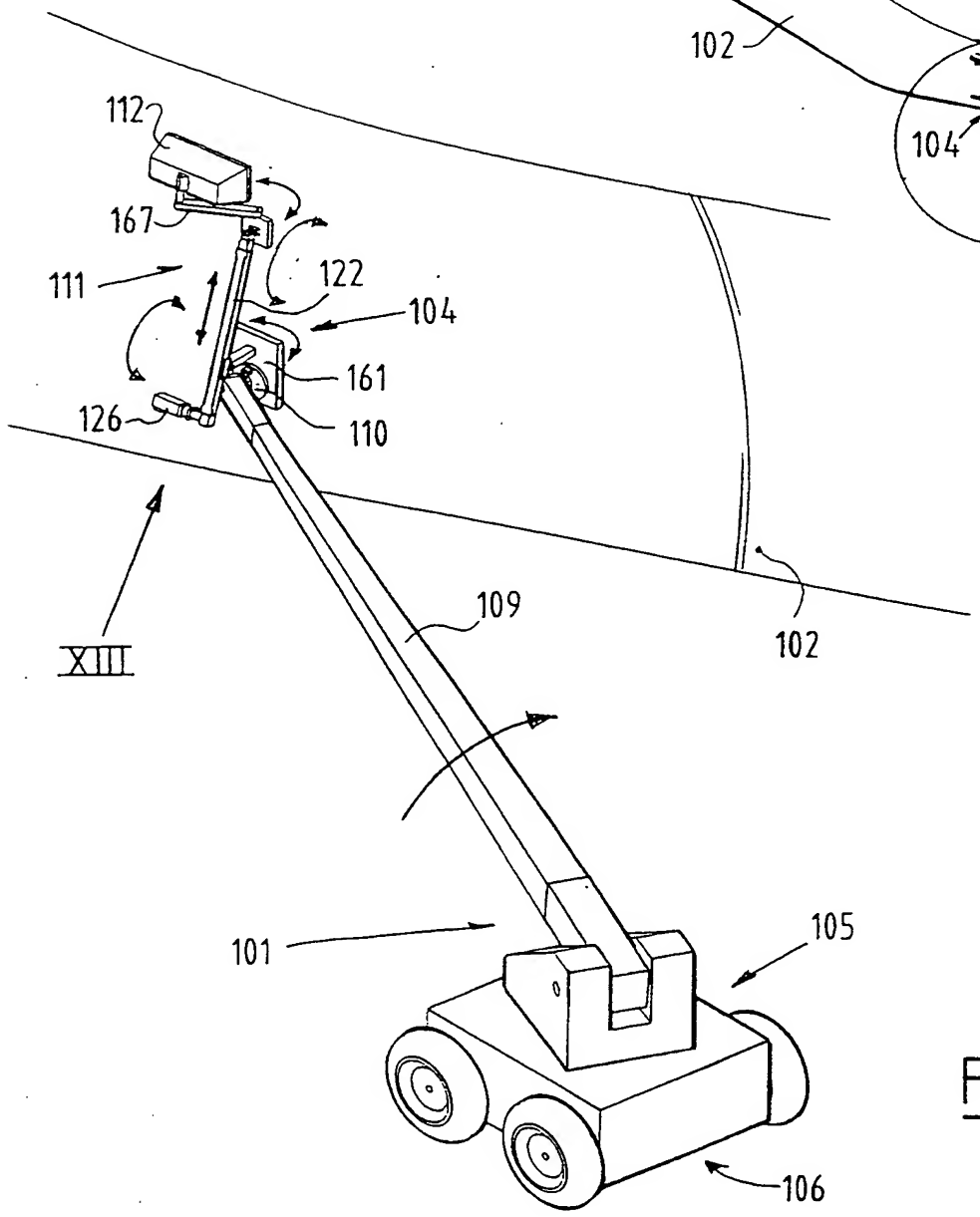


FIG. 12

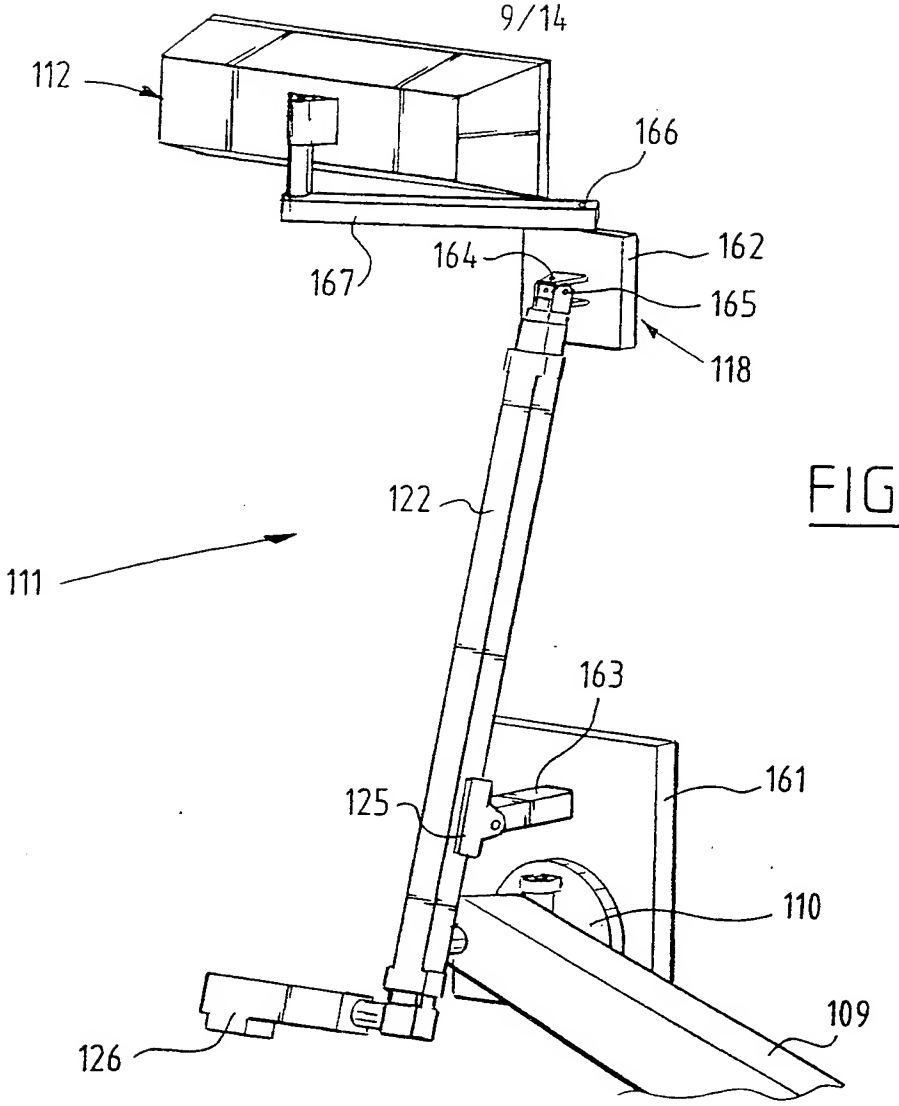


FIG. 13

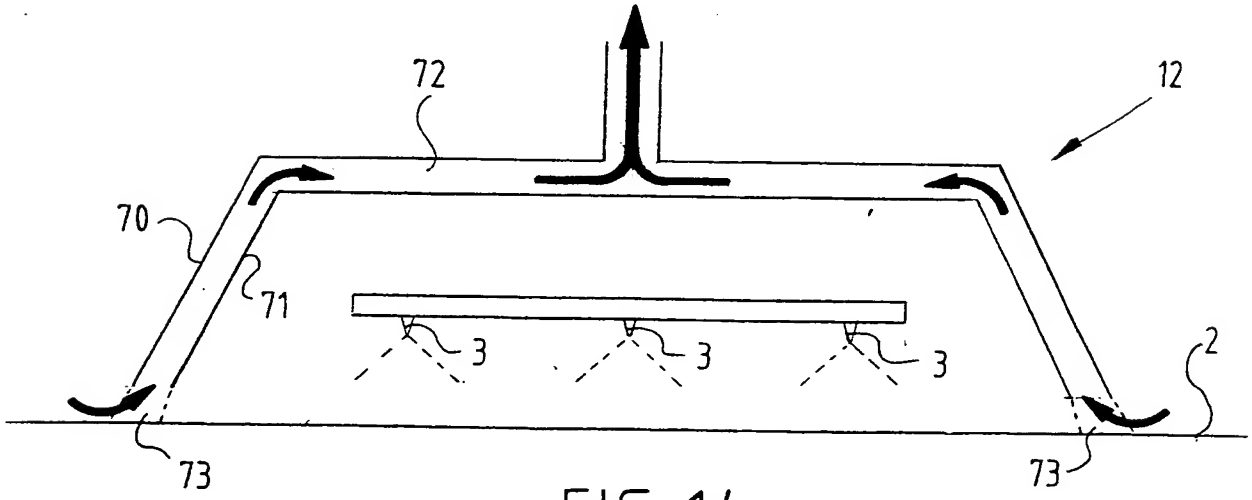


FIG. 14

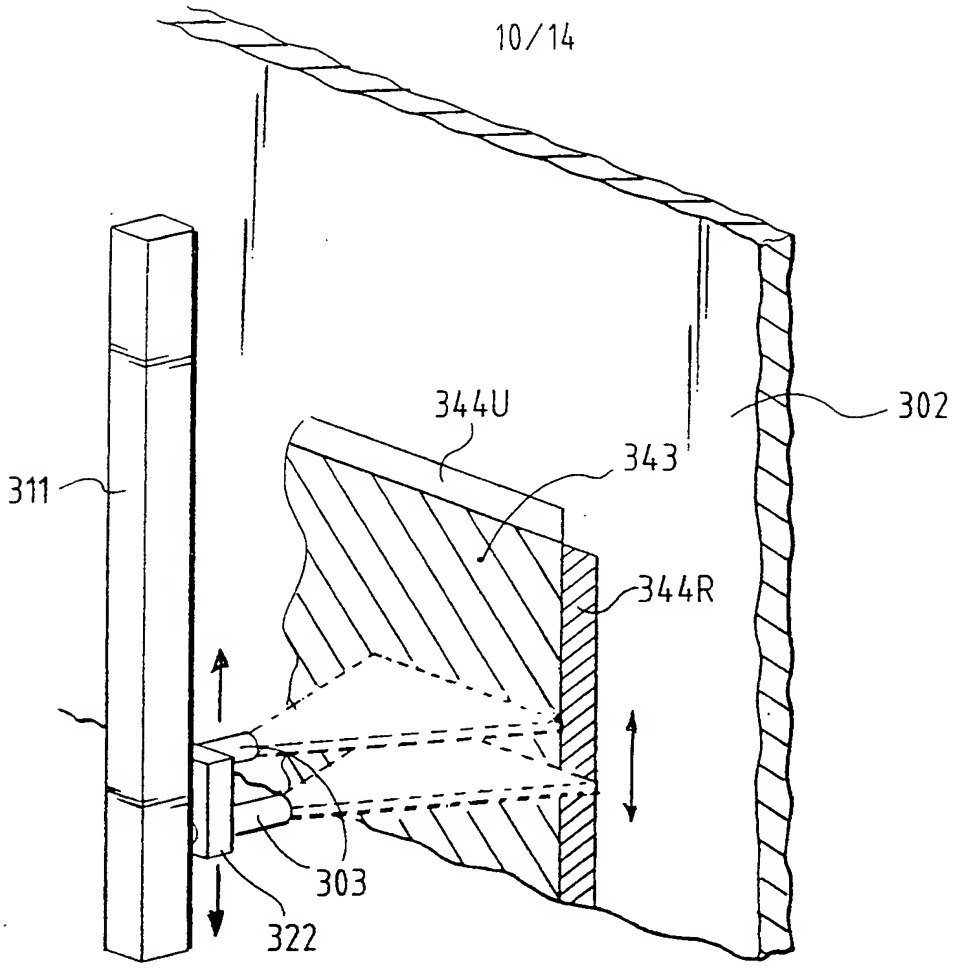


FIG. 15

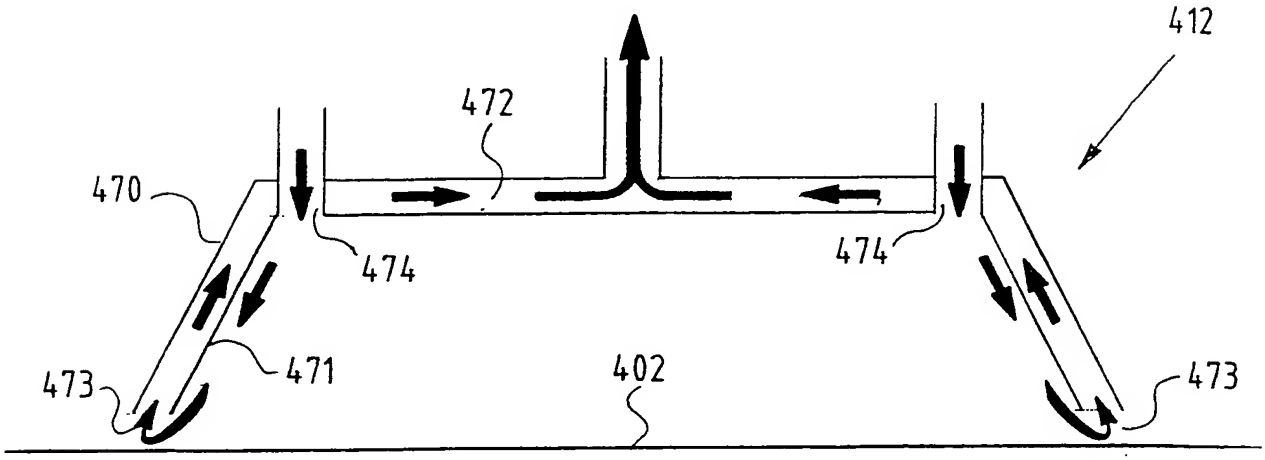


FIG. 16

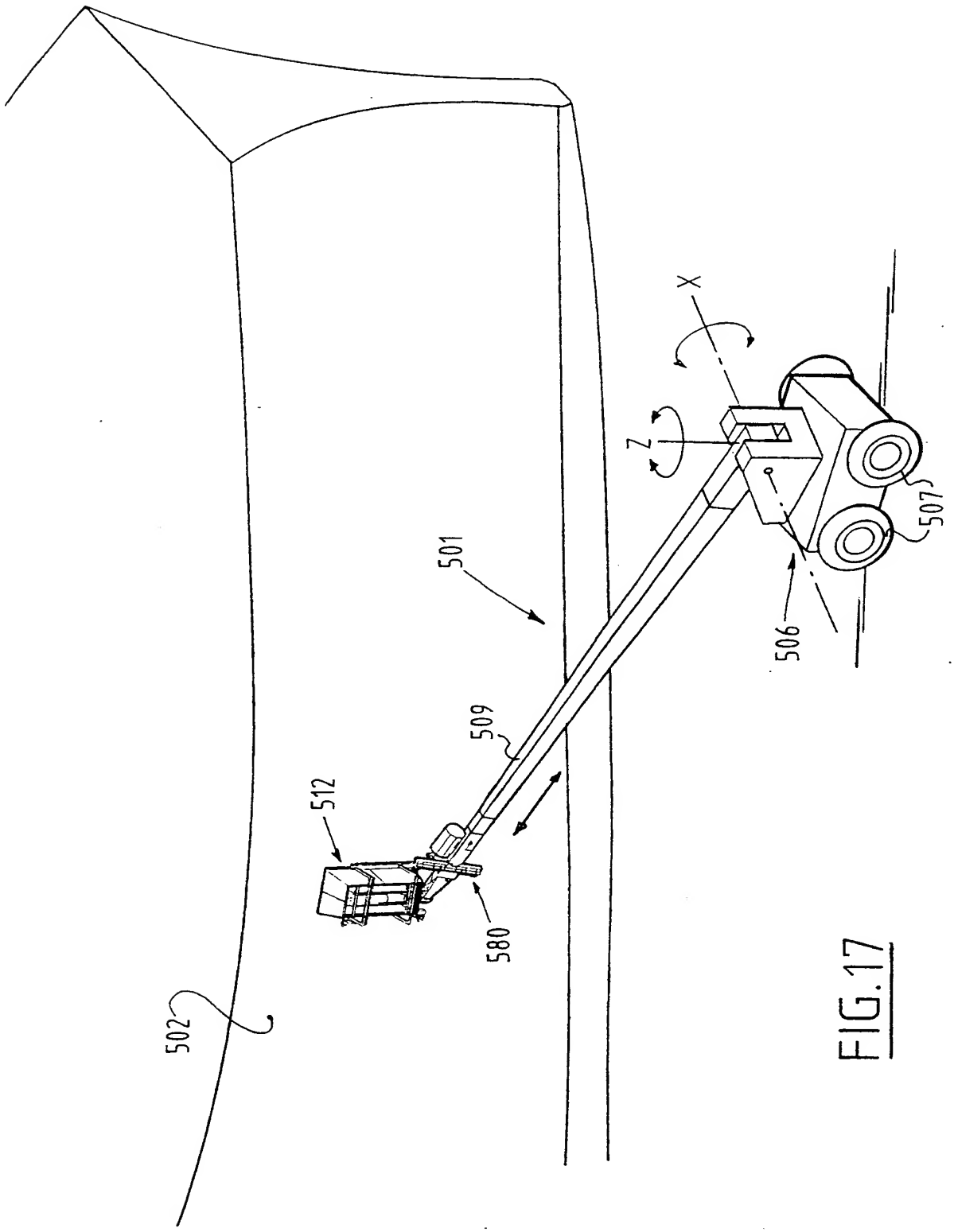


FIG.17

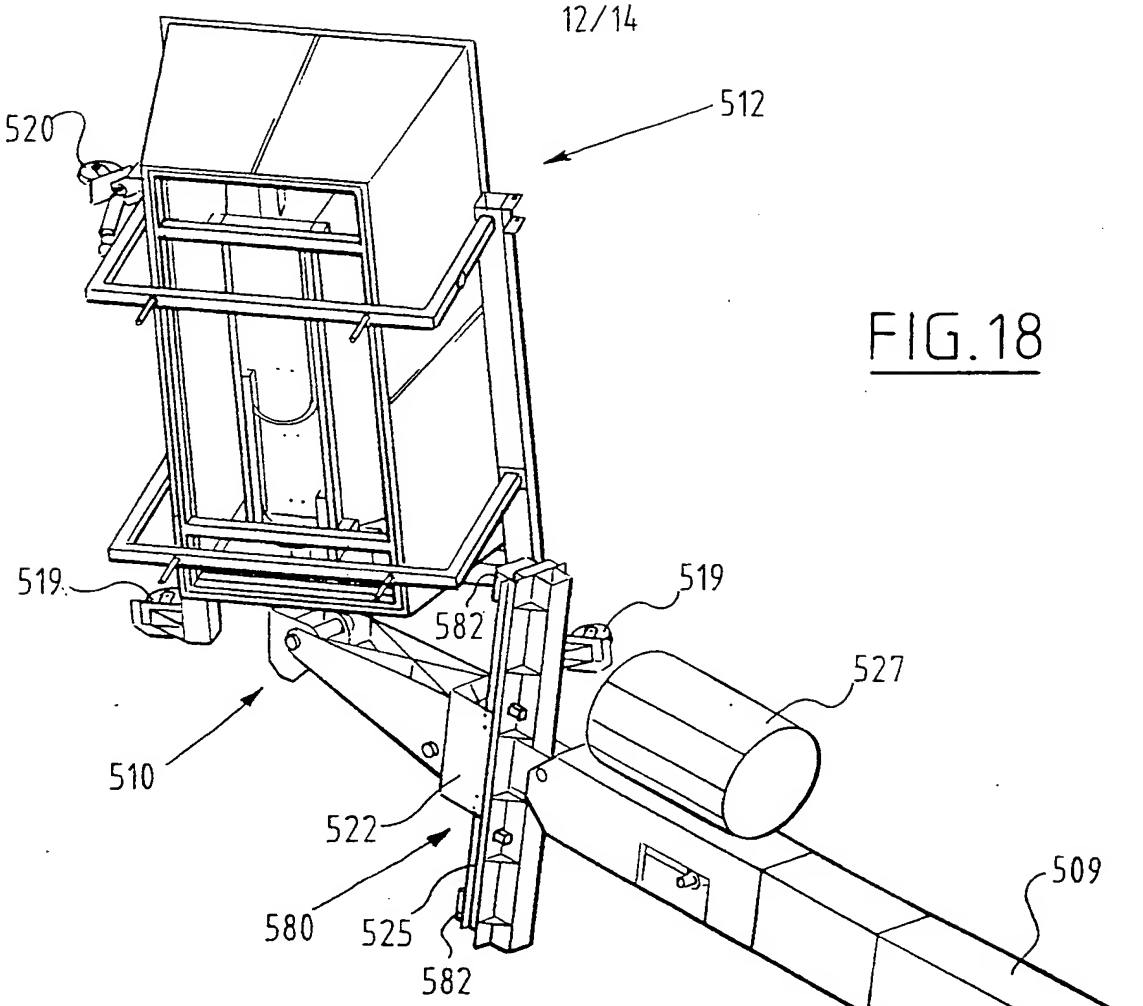


FIG.18

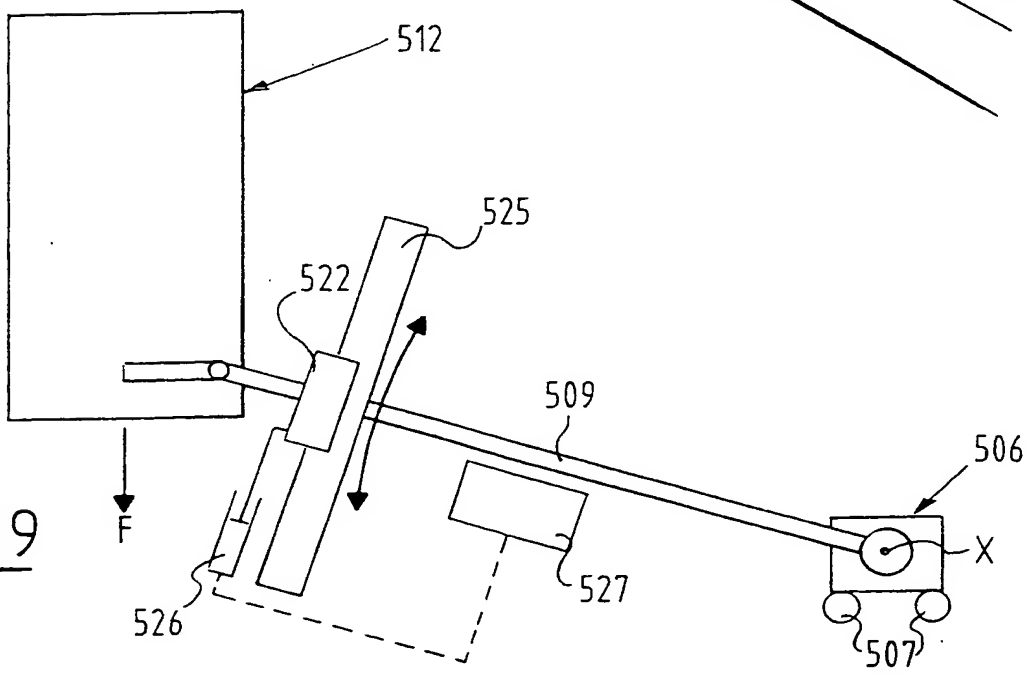


FIG.19

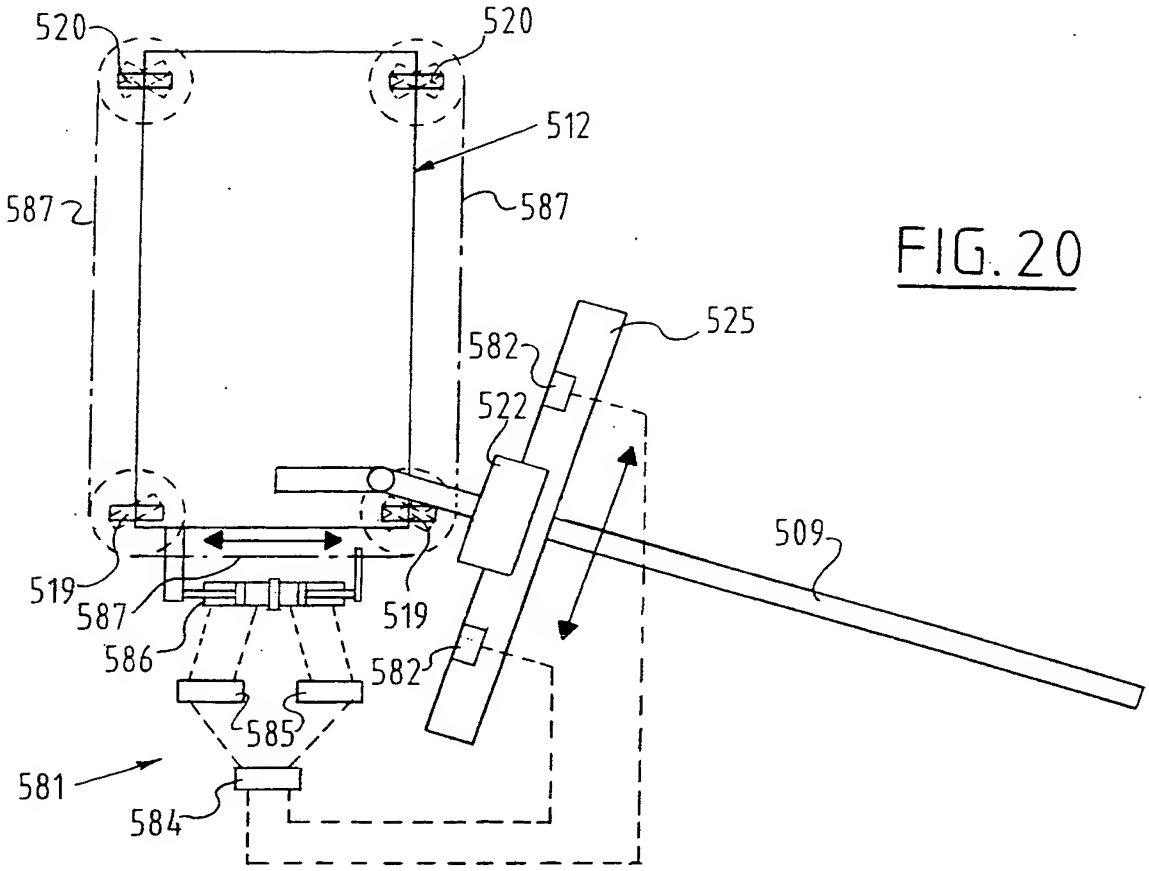


FIG. 20

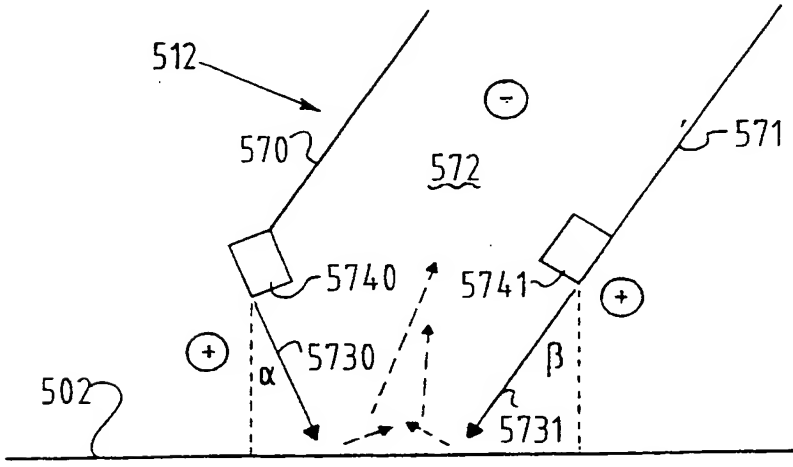


FIG. 21

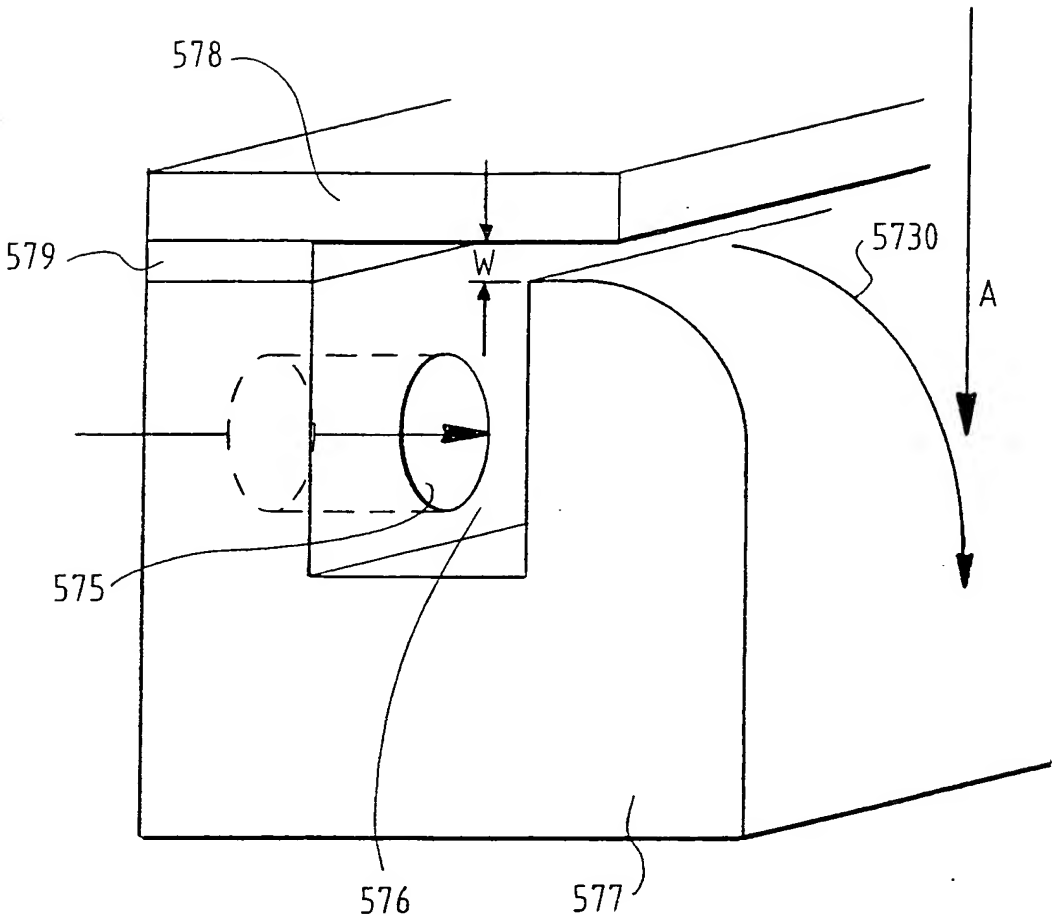


FIG. 22

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 May 2001 (17.05.2001)

PCT

(10) International Publication Number
WO 01/34309 A3

(51) International Patent Classification[7]: B05B 13/04, 15/04

(21) International Application Number: PCT/NL00/00772

(22) International Filing Date: 25 October 2000 (25.10.2000)

(25) Filing Language: Dutch

(26) Publication Language: English

(30) Priority Data:
1013384 25 October 1999 (25.10.1999) NL
1015263 22 May 2000 (22.05.2000) NL

(71) Applicant and
(72) Inventor: VROLIJK, Peter, William [NL/NL]: Koningslaan 63, NL-1406 KG Bussum (NL).

(74) Agent: BARTELDS, Erik; Arnold & Siedsma, Sweelinckplein 1, NL-2517 GK The Hague (NL).

(81) Designated States *(national)*: JP, US.

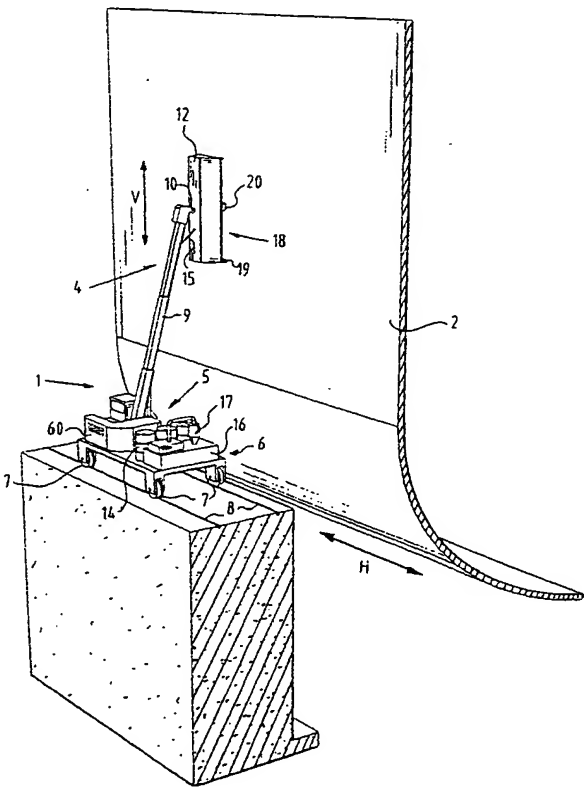
(84) Designated States *(regional)*: European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published:
— *with international search report*

(88) Date of publication of the international search report:
27 December 2001

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD AND DEVICE FOR SPRAYING A SURFACE AND SPRAY NOZZLE FOR USE THEREWITH



(57) Abstract: The invention relates to a method for spraying a surface, by causing the spray nozzle (20) to move by mechanical means through a determined stroke length in a first direction (V) along the surface, wherein the first and second direction (H) enclose an angle, this such that a spraying pattern is formed with parallel strips running in the first direction. The spray nozzle can be moved reciprocally through the stroke length in the first direction, wherein it may be active only during the forward stroke or the return stroke. The spray nozzle can be moved in the second direction such that edge parts of adjacent strips overlap each other and undergo the same spraying treatment as other parts of the strips. After spraying of a width a determined number of strips the spray nozzle can be displaced through the stroke length in the first direction, whereafter a subsequent width can be sprayed with a number of parallel strips, wherein edge parts of strips in adjacent widths can once again overlap each other. The mist created during spraying can be extracted and separated. The invention also relates to a device for performing the described method.

WO 01/34309 A3

INTERNATIONAL SEARCH REPORT

Int ational Application No
PCT/NL 00/00772

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B05B13/04 B05B15/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 1 364 107 A (HITACHI SHIPBUILDING ENG CO) 21 August 1974 (1974-08-21) page 3, line 78 - line 122	1-11,15, 23,24
X	DE 43 28 410 A (JERKEL SPRUEHSYSTEME GMBH) 9 March 1995 (1995-03-09) the whole document	1-4,7,9, 12-15, 17, 33-38, 42-44
X	PATENT ABSTRACTS OF JAPAN vol. 014, no. 184 (C-0709), 13 April 1990 (1990-04-13) -& JP 02 031850 A (MITSUBISHI HEAVY IND LTD), 1 February 1990 (1990-02-01) abstract	1-4,7,9, 15,18,19
A		17

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 June 2001	19/07/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Juguet, J

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/NL 00/00772

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 474 135 A (BELLAFIORE FRANCIS V) 2 October 1984 (1984-10-02) column 5, line 1 - line 16	1-4,7,9, 15,18,19
A	WO 91 16995 A (AMERICAN TELEPHONE & TELEGRAPH) 14 November 1991 (1991-11-14) abstract page 4, line 9 - line 22	5,6,10, 19-22

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/NL 00/00772

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 1364107 A	21-08-1974	JP 51038739 B	23-10-1976
		JP 48038335 A	06-06-1973
		JP 51039266 B	27-10-1976
		JP 48037896 A	04-06-1973
		JP 52015618 B	02-05-1977
		JP 49048168 B	19-12-1974
		DE 2164513 A	17-08-1972
		SE 387550 B	13-09-1976
DE 4328410 A	09-03-1995	NONE	
JP 02031850 A	01-02-1990	NONE	
US 4474135 A	02-10-1984	NONE	
WO 9116995 A	14-11-1991	US 5065692 A	19-11-1991
		DE 69110824 D	03-08-1995
		DE 69110824 T	22-02-1996
		EP 0480016 A	15-04-1992
		JP 7102338 B	08-11-1995
		JP 4506768 T	26-11-1992
		KR 174527 B	18-02-1999